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ABSTRACT

This document reports on a congressional hearing on the impact of technological advancements on employment. Testimony includes statements and prepared statements from individuals representing conservation of human resources, Columbia University; United Steelworkers of America; The Brookings Institution; Xerox Corporation; and Panel on Technology and Development, National Academy of Sciences. An appendix contains questions and answers submitted for the record. (YLB)

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THE EFFECTS OF TECHNOLOGICAL CHANGE ON THE LABOR FORCE

HEARING

BEFORE THE

TECHNOLOGY POLICY TASK FORCE

OF THE

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY HOUSE OF REPRESENTATIVES

ONE HUNDREDTH CONGRESS

FIRST SESSION

JULY 1, 1987

[No. 32]

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THE EFFECTS OF TECHNOLOGICAL CHANGE ON THE LABOR FORCE

WEDNESDAY, JULY 1, 1987

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
TECHNOLOGY POLICY TASK FORCE,
Washington, DC.

The technology policy task force met, pursuant to notice, at 9:30 a.m., in Room 2325, Rayburn House Office Building, the Honorable Buddy MacKay (chairman of the task force) presiding.

Also present: Dr. Chris Hill, Specialist, Science and Technology Policy, CRS; Dr. Donald Johnson, NBS; Dr. Karl Willenbrock, Executive Director, American Society of Engineering; Mr. Dale Compton, National Academy of Engineering.

Mr. MACKAY. I would now like to formally begin by welcoming the panel. We will be receiving testimony and discussing one of the central issues in technology policy in a democratic society. The subject is the effects of technological change on the labor force.

Our witnesses are among the foremost experts available. They represent differing viewpoints and differing backgrounds. We think it is going to be one of our best hearings.

I have a request that I need to, for the record, state. The Steel Workers Union would like to take pictures if there are no objections from members of the panel. The Chair hears none, so we will do that. Anyone else who would like to take pictures is welcome to do so. I might say to the Steel Workers Union, that puts you more at risk than it does us.

Our panel this morning—and we will hear from them in left to right order from this side, which would be right to left—Dr. Eli Ginzberg, Hepburn Professor Emeritus of Economics and Director of Conservation of Human Resources at Columbia University; Mr. Lynn Williams, President of the United Steel Workers of America; Dr. Robert Lawrence, Senior Fellow in Economics at Brookings; Mr. Paul Strassmann, retired Vice President at Xerox; and Dr. David Mowery, Study Director of the Panel on Technology and Employment at the National Academy of Sciences.

That concludes my opening comments.

Mr. Packard, would you care to make any comments?

Mr. PACKARD. Simply to express my pleasure in joining with you, Mr. Chairman, in welcoming our witnesses. There is certainly no question that employment impacts have certainly been impacted by technological advances. It is important that we discuss how we are going to look to the future in terms of resolving some of our

employment problems as it relates to displacement by technology and a variety of other things.

So I certainly am grateful to join with you gentlemen at the witness table. I trust that we will learn something together. Thank you very much for being with us.

Mr. MACKAY. Now, let me just say one other thing. Dr. Ginzberg has a noon plane to catch. At twenty minutes after 11:00 we think he should leave here. So at about 11:15 we are going to give you your opportunity to summarize, regardless of where the hearing is for the rest of us.

Dr. Ginzberg.

STATEMENT OF DR. ELI GINZBERG, HEPBURN PROFESSOR EMERITUS OF ECONOMICS, AND DIRECTOR, CONSERVATION OF HUMAN RESOURCES, COLUMBIA UNIVERSITY

Dr. GINZBERG. I appreciate that.

Looking around the room, I suppose what I bring to the meeting is a longer continuity and exposure to the problems than most. I did my first study of the unemployed in 1939 in New York City. So that goes back a while.

The other part of my background has to do with the fact that I was the Chair of the MDTA and CETA committees from 1962 to 1981. So I've had some experience with the flow of Federal dollars in this direction.

I think it is worthwhile to point out for the record that MDTA got passed by the Congress on a mistaken notion that technology was disemploying a lot of people in 1961/1962. That's how it got passed. Then when the economy picked up again in 1963/1964, we forgot about the technological impact and we were worried about other good things about the labor market. There were a lot of people that were having trouble getting jobs.

But it's interesting, just for the record, to remind everybody that it was not technology that got the Federal Government into the manpower business. My own view—and we've done a little book at Columbia during the past year called Technology and Employment, Conceptualization and Clarifications—our own view is that by and large technology can be said to have both the major impacts on employment in the very long term, and relatively minor impacts in the short term, except on very specific groups of workers and industries.

That is, in the long term all you have to do is look at American agriculture and realize that technology in the larger sweep of things brought the labor force down from 90 percent of the total labor force in agriculture to three percent or below. So there is no question about that.

On the other hand, I would say unquestionably that the major questions in labor markets come about when the economy fails to be able to provide enough jobs for everybody. The economy usually fails to provide enough jobs for everybody. In my experience the only time that the U.S. economy performed satisfactorily was in 1942/1943, when we had literally over full employment. We had emptied out the mental institutions in New York State and we

found jobs for those people. But some of them were so marginal that it would have been better not to have hired them.

So my view is, number one, the shortfall from full employment is the major cause of trouble. That doesn't deny that technology, especially in relationship to the trade dimensions—and Lawrence is going to talk about that—cannot and will not have bad effects upon certain groups of workers and in certain specific markets.

But my own view is that on the whole, the problem of technological displacement is bad when it comes to senior long term workers—and my neighbor here will talk to that, I assume—who had good union protection. They have been 30 years in an industry, and suddenly at 56, 57, 58, they are thrown out. Those are the people who haven't got much of an opportunity at all to get fitted back in.

One of my suggestions is that we do follow a European approach to that, and consider, at least from the ages of 58 to 62, some type of early entitlement to specia! social security to help those older people. I think when you're dealing with younger people, the important thing to do is to have hopefully the economy buoyant enough that with some kinds of money for counseling and job search and so on, you can move people around.

We saw that a large number of workers out of Detroit went to Houston. Then Houston fell on it's face, so they had to go back to Detroit. But by and large, if you're in the younger age groups, I think the outstanding feeling that I have about the American economy is that in a continuing expanding labor market—and we have had more and more jobs—the younger people can by and large make it.

Now, I want to raise the other issue that has me very bothered. I live in New York City. I have lived there all my life. I believe that the shift to the service economy, which is continuing to accelerate, where we now have three out of every four jobs in services, means that if one does not have minimum qualifying educational competencies, one is going to be out of that labor market.

I begin to see in New York, Chicago, Los Angeles and many other places, a serious danger to the stability of the society—not to the individuals of the society—of having youngsters coming of working age who lack the minimum qualifications to get employed in the new service economy.

We have all kinds of jobs in New York. We've had 400,000 jobs since our low point in 1977. But we have to import most of those people from other parts of the United States and from abroad. That is a very serious matter.

So I would argue that we have to give youngsters who don't make it through the regular school a second and third chance to somehow get themselves into the labor market and make up for what they didn't get the first time around.

I want to say one word about retraining. I think retraining is important for people who have the competencies to be retrained. I've looked at the Swedish system and the German system, and that is very important. But if you don't have the basic educational competencies, you can't be retrained. A lot of the automobile workers' experiences in retraining, especially in the Los Angeles area, from automobiles to computers, did not work. It just didn't work.

So I would look at retraining very cautiously for the people who need the most help. And the people who need the most help are the people who don't have the educational competencies.

That's about it.

[The prepared statement of Dr. Ginzberg follows:]

FEDERAL POLICIES TO STRENGTHEN THE U.S. LABOR FORCE

Eli Ginzberg, Columbia University

1. The following points derive from my half century research into labor force problems in the U.S. and abroad; and my oversight as Chair of the National Commission for Employment Policy (and predecessor agencies between 1962 and 1981) of $100 billion of federal expenditures for MDTA and CETA.

Shortfalls from full employment are the major cause for losses to experienced workers and to problems facing new entrants into the labor force.

Technology is a minor factor in depriving workers of jobs and income. The major factors are cyclical and structural shifts including loss of preexisting markets such as many U.S. manufacturers experience in recent years from the overvalued dollar.

In a relatively free trade world it is inevitable that some U.S. firms will lose their domestic market; and that American workers, many with long tenure will become unemployed. Those in high wage industries with good union contracts will have great difficulty in finding equivalent jobs in an increasing white collar economy.

2. What sensible steps can/should the Federal Government take to moderate the high losses suffered by some/many, but by no means all U.S. workers who become displaced or young workers who can't find a job.

Operating the economy closer to full employment would be the single largest contribution.

Providing second and third chance opportunities for young people who lack a high school diploma to obtain basic competences plus work experience. I also favor a federally funded jobs program with a basic competence component. With three out of four jobs in the service sector functional literacy requires 12 years of effective education.

JPTA should have additional funds at its disposal to facilitate counseling and job search for displaced workers.

3. Retraining is not useful for displaced workers who lack basic competences. They need help to find another job. They may need a publicly funded job or they may need early retirement benefits.

4. The best long-term prevention for costly displacement is to raise the competence level of all young people entering the work force so that they will be better able to fit into the ever more dominant service economy.

5. The continuance of racial discrimination compounds all of the above problems.

Mr. MACKAY. Thank you, Dr. Ginzberg.

Mr. Williams.

STATEMENT OF LYNN WILLIAMS, PRESIDENT, UNITED STEELWORKERS OF AMERICA

Mr. WILLIAMS. Thank you very much, Mr. Chairman.

I expect I can be more succinct or maybe as succinct if I stick with this statement a little bit. I'll try to leave some things out as I go along in terms of an opening presentation.

In the post-war period economic discussions, at least to the extent there was a reference to public policy measures, concentrated upon factors which induced economic growth. While inflationary pressures always were an inhibiting factor, constant increases in the gross national product were considered to be an attainable objective.

Paralleling this focus on wealth creation, there did emerge as a matter of affirmative public policy the conscious effort in the reallocation of income, especially as evidenced in the War on Poverty during the 1960's. There was also a Third World dimension of this

wealth reallocation, whereby international cooperation was directed to the sharing of the growth with developing countries. The emphasis was upon growth and a reallocation of the growth, both domestically and internationally, among low income groups.

However, such public policy measures adopted to achieve these objectives, while difficult to enact, did not have to confront the problem of wealth redistribution in a stagnant domestic or world economy. That environment has changed in the last few years. The industrialized countries have barely been able to hold their own. The U.S. economy is at a standstill, and indeed, suffered recessionary years. In many industries like steel, cyclical downward pressures have not relaxed. For the first four months of this year, steel mill shipments were 4.1 percent below 1986.

Now there are other contrasts. Instead of a growth experience, there is the phenomenon of industrial restructuring. This panel is addressing the issue of industrial transition, a somewhat softer term, but nonetheless one which conveys a certain degree of negative implications.

Additionally, while in previous years references to Third World economics connotated an international aspect to macroeconomic policy, nevertheless the bulwark of growth remained centered in the industrialized countries, both its productive and consumptive bases.

But now attention has been aroused by the emergence of the global market. Mass production processes in the basic industries—steel, auto fabrication and high tech ventures, semiconductors, telephone communications—are no longer the exclusive domains of the industrialized countries.

Unfortunately however, both for the Third World and ourselves, the markets for these products remain heavily dependent upon the industrialized world, and most predominantly upon the U.S. marketplace. Structural change and the global market, although inevitable developments, have arrived at a time of sharp economic problems and have seriously challenged our ability to cope with the transition.

I am aware that if one expresses caution about entrance into the global market, he stands vulnerable to the charge of protectionism. Nevertheless, I do believe that generally accepted international principles have not yet been defined or adopted, so that the participants in global market competition cannot be assured of fair competition, nor can the workers receive equitable and social justice treatment.

It has taken generations within our national marketplaces, and even more recently within the European Common Market, to arrive at a systematic set of principles—or regulations if you will—to prevent exploitation of workers and concentration of wealth. The global marketplace could put pressure upon these social gains and result in a gradual lowering of the standard of living of workers in industrialized countries.

There is need, therefore, for a period of adjustment and preparation. Our industries must be given appropriate opportunity to convert to a world class strategy and a competitive outlook. But then too, the global marketplace must be subjected to far more discipline over unacceptable practices than is now required.

Thus, for example, the United Steelworkers of America has been advocating as an element of global market preparation that trading partners recognize as a disciplined precedent to submitting products for international trade, that internationally recognized workers rights not be suppressed. We are maintaining in both U.S. trade law and in current GATT negotiations that suppression of these rights constitutes an unfair trade practice.

There is an unreasonable economic advantage being gained because the lack of international discipline allows and indeed by default encourages unfair wage competition. It is not enough for policy makers merely to affirm that such unfair competition can be offset by increased technology and productivity.

As an element in domestic industry adjustment, I should like to indicate one area of no small importance. Of particular concern to potentially displaced workers in restructuring industries is the availability of early pensions due to plant shutdowns. Almost all of our industrialized partners provide these older worker compensation measures, not only to facilitate structural changes, but also on the question of social equity.

Yet we are faced with an anomaly. Steel firms have declared themselves hampered by these exit costs and have been engaging in Chapter 11 bankruptcies in order to avoid these obligations. Furthermore, even when pension plans have been terminated and the PBGC assumes responsibility for guaranteeing the basic benefits, this agency insists upon intervening in collective bargaining agreements if the unions attempt to recover for the structurally displaced workers those shutdown benefits not guaranteed by the PBGC.

My point, Mr. Chairman, is that workers are unable to be sympathetic with the goals of industrial transition since there are little transitional programs assisting them.

I would not, however, wish to deny that public policy is beginning to respond to worker displacement. This Congress is on the verge of enacting a dislocated workers training program patterned after the Department of Labor Task Force recommendations. Yet of major debate is whether a generally recognized asset in worker adjustment, namely early intervention through a plant shutdown notification, should be incorporated in a comprehensive worker adjustment program.

Advance notice of shutdown is being bitterly resisted by business interests. Meanwhile, our European counterparts in the steel industry are preparing for a further reduction in steel making capacity by inaugurating another comprehensive program of steelworker adaptation measures.

According to the American Metal Market of June 18:

> The German steel industry and union intend to soften the impact of pending massive layoffs by using $465 million in public financing.

Industrial transition requires an industrial policy. There is no doubt that other countries, either those with emerging steel capacity or those engaged in retrenchment, approach these major investment or disinvestment decisions through some form of industrial strategy. Presently, there is no such forum for evolving strategic

approaches which take into consideration both the corporate financial repercussions and the worker community losses.

The Steelworkers have suggested an expansion of tripartite committees into decisionmaking or policymaking bodies capable of coming to grips with the restructuring problems. There is the potential for developing such an approach to be found in the amendments proposed by the Congressional Trades Committee to the Section 201 or safeguard clause of our trade law, wherein there would be interactive dialogues among the affected parties and an import control petition and the submission of an adjustment plan as a concomitant part of a trade relief response to a declining industry.

Let me hasten to add, however, that industrial transition does not necessarily mean transition from a declining industry to an emerging one, as mentioned in your staff draft for this panel. Certainly the economy as a whole will experience the evolution of new industries. The trauma to the declining industry is not eased because of these new emerging industries. Neither are the workers absorbed by them.

For the most part, blue collar workers, for instance in the steel industry, tumble down the income line and land in traditional lower wage jobs. Without a transitional strategy, this cycle will not be broken. Hence, we would caution against transition scenarios which assume the sharp decline or demise of a particular industry.

Indeed, we would advocate that there be a transition to a more world class format for the same industry. We are particularly insistent upon this concept in the steel industry because there seems to be an almost universal acceptance of the need for a substantial reduction in capacity. Capacity reduction needs to be consistent with market demands, but should not be propelled by the export oriented growth strategies of other countries. These strategies are reaching an end to their usefulness.

Steelmaking countries with excess capacity will have to realize that demand growth in their own market alone will justify the existence of their productive capacity. Unfortunately, these export-led strategies have allowed the build-up of enormous trade surpluses which are also a detriment to the world trading system.

These situations will eventually have to be adjusted. In the interim it would be extremely disadvantageous for the U.S. to abandon its productive capacity, especially in steel, pending the readjustment of international trade balances.

I would also like to call the Chairman's attention to the fact that the export attraction for many of the new industrializing countries is not entirely originating from economic factors within their own economics. The Journal of Commerce on June 24 reports:

> U.S. investments in countries such as Taiwan and South Korea have been aimed largely at producing for the U.S. market. Up to one-third of Taiwan's exports to the United States last year, for example, originated in U.S.-owned plants on the island, said an official at the American Institute in Taiwan, which functions as the unofficial U.S. embassy there. In the case of Singapore, $2.2 billion, about half of its total 1986 exports to the United States, came from U.S. companies there. The majority of the $670 million worth of manufactured goods exported from the Philippines to the United States last year was produced by subsidiaries of U.S. companies, especially in the semiconductor industry. Total Philippine exports to the United States in 1986 were valued at $759 million. The United States is Hong Kong's largest market and has some $6 billion invested there. But given Hong Kong's open economy, there are no detailed records concerning the operations of U.S. companies there.

The basic contention is that such excess capacity, which in part has produced excessive trade surpluses, cannot be sustained and will eventually be decreased or idled. Under these circumstances it would be very premature for American industry to reduce its capacity.

Additionally, some of the decline in steel production has been due to a trade deficit in indirect steel. That is, in steel content imports. As the exchange rates come under control, it is anticipated that some of this trade deficit will recede. Again, it would be premature that steel capacity be unduly withdrawn.

I believe that my main emphasis is upon the need for a forum in which we can coordinate various government policies regarding industrial transition. Congress might, without such industrial coordination, enact measures based upon the assumption of capacity reduction to facilitate such reductions by providing economic and tax incentives or anti-trust relaxations for closure. An uncoordinated ad hoc approach of that type would be a mistake.

I wish to reiterate that the loss of these basic industries' jobs is not being replaced by comparable income level jobs in the service sectors. It would be misleading to assume that since the unemployment rate is relatively low, according to your staff notice, that the process of readjustment is being successful. Actually, we are witnessing the downgrading of the standard of living, not only of currently displaced blue collar workers, but the freezing of future income opportunities for new workers.

We do, however, recognize that profound structural changes are occurring and will continue. In 1977 there was approximately 160 million tons of steelmaking capacity, employing over 425,000 workers. Today the capacity is near 112 million tons, and only 180,000 steelworkers are employed. Adjustment is taking place, but for workers it is traumatic.

Emphasis upon new technology is warranted, but there must be a social commitment to workers. So far we have not been able to develop a forum for the implementation of a social contract. It is that aspect of adjustment to transition to which I urge this committee's particular attention.

Thank you.

[The prepared statement of Mr. Williams follows:]

TESTIMONY

of

Lynn Williams, President

UNITED STEELWORKERS OF AMERICA

before the

Technical Policy Task Force
House Committee on
Science, Space & Technology

on

Industrial Transition
and
Labor Policies

July 1, 1987
Washington, D.C.

Growth and Allocation

In the post-war period, economic discussions, at least to the extent there was a reference to public policy measures, concentrated upon factors which induced economic growth. While inflationary pressures always were an inhibiting factor, constant increases in the gross national product were considered to be an attainable objectives. Paralleling this focus on wealth creation, there did emerge, as a matter of affirmative public policy, a conscious effort in the reallocation of income, especially as evidenced in the War on Poverty during the '60's. There was also a Third World dimension of this wealth reallocation, whereby international cooperation was directed to the sharing of the growth with developing countries. The emphasis was upon growth and a reallocation of the growth both domestically and internationally among low-income groups. However, such public policy measures adopted to achieve these objectives, while difficult to enact, did not have to confront the problem of wealth redistribution in a stagnant domestic or world economy.

That environment has changed in the last few years. The industrialized countries have bearly been able to hold their own. The U.S. economy is at a standstill and, indeed, suffered recessionary years. In many industries, like steel, cyclical downward pressures have not relaxed. For the first four months of this year, steel mill shipments were 4.1% below 1986.

According to The Wall Street Journal, economic forecasters see slow growth for the rest of the year:

> Blue Chip Economic Indicators, a newsletter that each month polls 51 leading forecasters . . . estimated quarterly gains of appreciatively smaller magnitudes /than previously reported/--only 1.5% in the current quarter, 2.7% in the third, 2.9% in the fourth and 3% in the first quarter of 1988.

Restructuring and Global Market

But now there are other contrasts. Instead of a growth experience, there is the phenomenon of industrial restructuring. This panel is addressing the issue of industrial transition--a somewhat softer term but nonetheless one which conveys a certain degree of negative implications.

Additionally, while in previous years, references to Third World economics connotated an international aspect to macro-economic policies, nevertheless the bulwark of growth remained centered in the industrialized countries--both its productive and consumptive bases. But now attention has been aroused by the emergence of the global market. Mass production processes in the basic industries (steel, auto, fabrication) and high technology ventures (semiconductors, telecommunications) are no longer the exclusive domains of the industrialized countries. Unfortunately, however, both

for the Third World and ourselves, the markets for these products remain heavily dependent upon the industrialized world--and most predominantly upon the U.S. marketplace.

Adjustment and Preparation

Structural change and the global market, although inevitable developments, have arrived at a time of sharp economic problems and have seriously challanged our ability to cope with the transition. I am aware that if one expresses caution about entrance into the global market, he stands vulnerable to the charge of protectionism. Nevertheless, I do believe that generally accepted international principles have not yet been defined or adopted so that the participants in global market competition cannot be assured of fair competition nor can the workers receive equitable and social justice treatment. It has taken generations, within our national marketplaces and even more recently within the European Common Market, to arrive at a systematic set of principles--or regulations, if you wish--to prevent exploitation of workers and concentration of wealth.

The global marketplace could put pressure upon these social gains and result in a gradual lowering of the standard of living of workers in industrialized countries. There is need, therefore, for a period of adjustment and

preparation. Our industries must be given appropriate opportunity to convert to a world-class strategy in their competitive outlook. But then, too, the global marketplace must be subjected to far more discipline over unacceptable practices than is now required.

Thus, for example, the United Steelworkers of America has been advocating, as an element of global market preparation, that trading partners recognize--as a discipline precedent to submitting products for international trade--that internationally recognized workers rights not be suppressed. We are maintaining in both U.S. trade law and in current GATT negotiations that suppression of these rights constitutes an unfair trade practice. There is an unreasonable economic advantage being gained because the lack of international discipline allows and, indeed by default, encourages unfair wage competition. It is not enough for policymakers merely to affirm that such unfair competition can be offset by increased technology and productivity.

Exit Costs

As an element in domestic industry adjustment, I should like to indicate one area of no small importance. Of particular concern to potentially displaced workers in

restructuring industries is the availability of early pensions due to plant shutdowns. Almost all of our industrialized partners provide these older-worker compensation measures not only to facilitate structural changes. There is also a question of social equity. Yet, we are faced with an anomaly. Steel firms have declared themselves hampered by these "exit costs" and have been engaging in Chapter 11 bankruptcies in order to avoid these obligations. Furthermore, even when pension plans have been terminated and the PBGC assumes responsibility for guaranteeing the basic benefits, this agency insists upon intervening in collective bargaining agreements if the unions attempt to recover for the structurally displaced workers those shutdown benefits not guaranteed by the PBGC. My point, Mr. Chairman, is that workers are unable to be sympathetic with the goals of industrial transition since there are little transitional programs assisting them.

Closure Measures: Notification

I would not, however, wish to deny that public policy is beginning to respond to worker displacement. This Congress is on the verge of enacting a dislocated workers' training program patterned after the DOL Task Force recommendations. Yet, of major debate is whether a

generally recognized asset in worker adjustment; namely, early intervention through plant shutdown notification should be incorporated in a comprehensive worker adjustment program. Advance notice of shutdown is being bitterly resisted by business interests.

Meanwhile, our European counterparts in the steel industry are preparing for a further reduction in steelmaking capacity by inaugurating another comprehensive program of steelworker adaptation measures. According to the American Metal Market (June 18, 1987), the German steel industry and union intend to soften the impact of pending massive layoffs by using $465 million in public financing.

> The plan has not been fully detailed, but it is intended to provide funding for job retraining and early retirement schemes for the 25,000 to 30,000 German steelworkers who may be laid off because of losses by the country's leading steelmakers and community-wide moves to cut excess capacity. It is still unclear if the plan includes aid for steel companies losing capacity.
>
> Under the proposal, at least $465 million would be needed from the public sector for layoff payments, re-employment in non-steel sectors and job retraining programs. At least half of this amount would come from the German government, while the rest would be provided by the European Commission.

Industrial transition requires an industrial policy. There is no doubt that other countries, either those with emerging steel capacity or those engaged in retrenchment, approach these major investment or disinvestment decisions

through some form of industrial strategy. Presently, there is no such forum for evolving strategic approaches which take into consideration both the corporate financial repercussions and the worker/community losses.

Restructuring Forums

The Steelworkers has suggested an expansion of tripartite committees into decisionmaking or policymaking bodies capable of coming to grips with the restructuring problems. There is the potential for developing such an approach to be found in the amendments, proposed by the Congressional trades committees to the Section 201 or safeguard clause of our trade law, wherein there would be "interactive dialogues" among the affected parties in any import control petition and the submission of an adjustment plan as a concomitant part of a trade relief response to a declining industry.

Capacity Reduction: Export Strategies

Let me hasten to add, however, that industrial transition does not necessarily mean transition from a declining industry to an emerging one, as mentioned in your staff draft for this panel. Certainly, the economy as a whole will experience the evolution of new industries. But

the trauma to the declining industry is not eased because of these new emerging industries. Neither are the workers absorbed by them. For the most part, blue-collar workers, for instance in the steel industry, tumble down the income line and land in traditional lower wage jobs. Without a transitional strategy, this cycle will not be broken.

Hence, we would caution against transition scenarios which assume the sharp decline or demise of a particular industry. Indeed, we would advocate that there be a transition to a more world-class format for the same industry.

We are particularly insistent upon this concept in the steel industry because there seems to be an almost universal acceptance of the need for a substantial reduction in capacity. Capacity reduction needs to be consistent with market demands but should not be propelled by the export-oriented growth strategies of other countries. These strategies are reaching an end of their usefulness. Steelmaking countries with excess capacity will have to realize that demand growth in their own market alone will justify the existence of their productive capacity. Unfortunately, these export-led strategies have allowed the build up of enormous trade surpluses which are also a detriment to the world trading system. These situations

will eventually have to be adjusted. In the interim, it would be extremely disadvantageous for the U.S. to abandon its productive capacity, especially in steel, pending the readjustment of international trade balances.

I would also like to call the Chairman's attention to the fact that the export attraction for many of the newly industrializing countries is not entirely originating from economic factors within their own economics. The Journal of Commerce (June 24, 1987) reports:

> For the past two decades, U.S. multinational corporations have been pouring money into manufacturing operations in Asia's 'four tigers'--Hong Kong, Singapore, South Korea and Taiwan --along with less-developed but growing economies in the Philippines, Malaysia and Thailand.
>
> U.S. investments in countries such as Taiwan and South Korea have been aimed largely at producing for the U.S. market. Up to one-third of Taiwan's exports to the United States last year, for example, originated in U.S.-owned plants on the island, said an official at the American Institute in Taiwan, which functions as the unofficial U.S. embassy there.
>
> U.S. investments in these countries are shifting from low-end products such as textiles and footwear to high-value goods such as electronic components, computers and automobiles, largely for shipment back to the United States. Detailed figures are often hard to come by, but the scale is vast, judging by industry and other estimates given to The Journal of Commerce.
>
> In the case of Singapore, $2.2 billion -- about half its total 1986 exports to the United States -- came from U.S. companies there.
>
> The majority of the $670 million worth of manufactured goods exported from the Philippines to the United States last year was produced by

> subsidiaries of U.S. companies, especially in the semiconductor industry. Total Philippine exports to the United States in 1986 were valued at $759 million.
>
> The United States is Hong Kong's largest market and has some $6 billion invested there. But, given Hong Kong's open economy, there are no detailed records concerning the operations of U.S. companies there.

This is not an indigenous economic situation to which U.S. manufacturers should sacrifice productive capacities. Actually, the Institute for International Economics in a report, "Adjusting to Success," charges,

> The four spectacularly successful newly industrializing economies of East Asia--Hong Kong, Korea, Singapore, and Taiwan--have often been held up as a model for emulation by other developing countries. But today there is cause for concern that their actual or incipient current account surpluses both endanger their continued economic progress and hinder global balance of payments adjustment.
>
> The major threat to continued progress in the East Asian NICs . . . is their growing external surpluses. These surpluses divert resources from high-yielding domestic investments into lower yielding foreign assets, distort domestic investment toward an excessive focus on export and import-competing industries, deter desirable upgrading of the composition of exports, create inflationary pressures through the monetary effects of the buildup of reserves, increase the probability that much more precipitate adjustment will be required later (as in Japan now), and unduly limit the growth of internal consumption.

The basic contention is that such excess capacity, which in part has produced excessive trade surpluses, cannot be sustained and will eventually be decreased or idled.

Under these circumstances, it would be very premature for American industry to reduce its capacity.

Capacity Reduction: Indirect Steel Imports

Additionally, some of the decline in steel production has been due to a trade deficit in indirect steel; i.e., in steel-content imports. As the exchange rates come under control, it is anticipated that some of this trade deficit will recede. Again, it would be premature that steel capacity be unduly withdrawn.

Summary

I believe that my main emphasis is upon the need for a forum in which we can coordinate various government policies regarding industrial transition. Congress might, without such industrial coordination, enact measures--based upon the assumption of capacity reduction--to facilitate such reductions by providing economic and tax incentives or antitrust relaxations for closures. An uncoordinated ad hoc approach of that type would be a mistake.

I wish to reiterate that the loss of these basic industries jobs is not being replaced by comparable income level jobs in the service sectors. It would be misleading to assume that since the unemployment rate is relatively low, according to your staff notice, that the process of

readjustment is being successful. Actually, we are witnessing the downgrading of the standard of living not only of currently displaced blue-collar workers, but the freezing of future income opportunities for new workers.

We do, however, recognize that profound structural changes are occurring and will continue. In 1977, there was approximately 160 million tons of steelmaking capacity employing over 425,000 workers. Today, the capacity is near 112 million tons and only 180,000 steelworkers are employed. Adjustment is taking place, but for workers it is traumatic. Emphasis upon new technology is warranted. But there must be a social commitment to workers. So far, we have not been able to develop a forum for the implementation of a social contract. It is that aspect of adjustment or transition to which I urge this Committee's attention.

Mr. MACKAY. Thank you, Mr. Williams.
Dr. Lawrence.

STATEMENT OF ROBERT LAWRENCE, SENIOR FELLOW IN ECONOMICS, THE BROOKINGS INSTITUTION

Dr. LAWRENCE. Thank you very much.

In my comments I would like to deal with two issues. The first, I would like to talk about some conceptions of change in our economy. Indeed, some misconceptions about the nature of structural change. In particular, the influence of the global economy. Then I would like to talk briefly about some policy suggestions that I believe would facilitate industrial adjustment in the global economy.

I would like to direct your attention to a table in my testimony following page 7. There are three basic notions which are very common today, which attempt to explain our performance in international trade and the emergence of the very large trade deficit which we have experienced over the last five years.

These notions essentially suggest that there is some intrinsic inability of the United States to compete in international markets. Indeed, advocates who advance at least two of those notions argue that it is essential that we move to an extensive system of managed trade if we're ever going to get our trade deficit down.

These conceptions really argue, first, what I call the low wage argument. That is essentially that if workers are paid $2 an hour in Korea and they are paid $12 an hour in the United States, there is no way the U.S. can compete. We have to either get their wages up, or our workers will face a leveling down in their wages. That is sort of the low wage argument. It argues that predominantly our trade deficit has been the result of these forces.

A second argument which is a very popular argument, particularly with Congress, is the unlevel playing field argument. The argument here is that foreign governments are interventionist. They give their firms more assistance than the American Government does. In this system, the ball inevitably bounces towards the U.S. goal line. The United States can't compete under these conditions.

The third argument says that essentially Americans have forgotten how to produce good quality products. It doesn't matter what the price is. We can't sell abroad unless we learn to improve our quality.

There is an element of truth in each of these arguments. There are obviously instances when they do apply. But the question is whether they should be the driving force behind our trade policy. I would submit they ought not to, precisely because they can't account for the facts. What are those facts?

Let's look at Table I in my testimony. The first thing to note is the pervasiveness of our trade deficit. The declines have come virtually evenly in capital goods, in automotive products, and in consumer goods; $43 billion in capital goods between 1981 and 1986, $45 billion in automotive products, $44 billion in consumer goods—as you see, almost evenly divided and pervasive across all commodities.

If you look at the regional movements in our trade balance, what you discover there is that it is pervasive. It is with every major

trading partner that we have; and what is remarkable, it is almost proportionally distributed across our trading partners. I have done some exercises where you simply give each trading partner their share of our imports and our exports as they were in 1981, and forecast what would have happened if they had simply picked up their proportion.

Lo and behold, what you find, if we take the case of Japan for instance, is that their proportional share would have been $38.4 billion. That's in my second table. Lo and behold, that's exactly what they got.

So these are the facts then; a pervasive erosion in our trading performance across almost every product category, and almost proportional with every trading partner. How does that square with those interpretations of our trade difficulties? Let's think about that unlevel playing field argument for instance.

First, remember that in 1981 the United States actually had a surplus in its trade in manufactured products of about $11 billion. So there was nothing in the playing field then that prevented us from getting a surplus. What's happened has happened since then. So things must have changed in some way in order to tilt the playing field, if we're going to take that explanation seriously.

Yet, if we look at the pervasiveness of this erosion, we have to believe in nothing short of a global conspiracy because it's not confined to one or two of our trading partners. It is pervasive. If you actually look at the facts, what has been happening since 1981 is, if anything, protection has been on the rise in this country relative to our trading partners. It simply cannot account for this erosion in our trade balance. The proportionality confounds the argument, that it's due to unfair practices of one particular trading partner.

Let's think of the low wage argument. Well, let's look at what happened with developing countries. What we find is that as a share of our imports, developing countries accounted for 25 percent of our manufactured imports in 1981, and 25.9 percent in 1986. It is not a low wage phenomenon at all.

Indeed, what is striking is that more than two-thirds of our international competition in import markets is coming from developed countries, those countries which have wage rates that are rather similar to ours.

So I would assert that neither of these two explanations can account for the facts. Indeed, I would suggest that by and large America can compete internationally, provided it has higher productivity in order to offset the low wages in foreign countries. After all, this is not a new experience for the United States.

In 1960, the U.S. economy paid wages which were more than two times those in the rest of the world. Indeed, what is interesting is that in 1960, two-thirds of our manufactured imports came from low wage countries. Recall that in 1960 low wage countries included Japan and Europe. So that a much smaller proportion of our imports today come from those low wage countries, although their identities have changed, than did earlier.

What about the quality argument? Again I'm not saying there isn't some element of truth in it. But how can that account for the pervasiveness of this decline? Capital goods, auto products, con-

sumer goods, evenly distributed. If quality erodes, it erodes in some particular sectors. It also doesn't occasion a precipitous decline.

No. If you want to understand why we have a trade deficit you have to look at something we economists call macroeconomic. It's aggregative. Only if it were an aggregative phenomenon could you explain the pervasiveness of this change. Indeed, until we change our macroeconomic policies, we won't get a reversal of this aggregate of change.

It has to do with policies adopted in the United States. It has to do with the fact that we as a country are spending much more than we produce. When you spend more than you produce, you have to get foreign goods to make up the difference. Therefore, there is this direct link between our two deficits—the Federal budget deficit and the trade deficit. That is the essential message of the first part of my paper.

I also deal with the issue of whether or not the United States is being deindustrialized. There are a number of interpretations of the term "deindustrialization". Again, I direct you to a chart following page 17 of my testimony.

What is interesting there—The chart is divided into two panels. It all depends on how you define deindustrialization if you want to come up with an answer. What I would point out though is that in panel A, I give the share of manufacturing in our GNP. What is really striking about that panel is that essentially, measured in 1982 dollars, manufacturing is roughly the same share of our gross national product as it has been in most of the post-war period.

Indeed, if you look in real quantitative terms, goods are as important an element in our production today as they were in 1980 and as they were in 1960. The United States is not losing its capacity to produce goods. Individual U.S. industries have indeed experienced tremendous difficulties. But in the aggregate, if you look at measures of our industrial base, our capacity to produce in manufacturing, you find that that has increased by about 20 percent since 1980, roughly in line with the rest of our economy.

So I would suggest that we do have sectors that are impacted disproportionately by trade. But that broadly, our manufacturing base has continued to expand roughly in line with the rest of our economy. If you do look though at the share of manufacturing in employment in our economy, you see a noticeable decline that I record in panel B.

That is the result not of a loss of our ability to produce goods. Indeed, a result of our enhanced ability to produce goods. More rapid productivity growth in the goods productive sector has been the dominant reason for the share of manufacturing in our employment.

I also deal in my testimony—but I won't go into it here—with the nature of the income earnings potential broadly in manufacturing and the rest of the economy. The argument that our middle class could be eroded as a result of the transition, as a result of this declining share—I say it simply doesn't hold up if you look at an aggregate of an analysis of that particular phenomenon.

There are differences indeed, and I'll come to it in a moment, in the earnings capacity in certain of our heavy industries, particularly in steel and in automobiles. Workers who are dislocated do expe-

rience declines. But as a broad generalization of the effect of a small decline in the share of manufacturing in employment in our total economy, it simply doesn't hold up.

In addition, I don't find any substantial inability of the high technology manufacturing sectors of our economy to provide middle and upper income earnings jobs. Indeed, the reverse is true. They provide relatively higher proportions than the more basic parts of the manufacturing sector.

I do, however, believe that in addition to changing our macroeconomic policies, which are essential, we could change our policies to deal with dislocation in this economy. The work that I have done in this area looks specifically at dealing with dislocation as a result of international trade.

I personally am very skeptical of coordinated orchestrated programs in order to deal with decline in a specific industry. I believe if an industry is being injured as a result of imports, it should come to the International Trade Commission, it should prove that it is being injured. If it is being injured, a declining tariff should be provided in the form of protecting that sector.

I do not think that the government should get involved in detailed programs of the nature of conditionality, where protection is provided on a quid pro quo basis, fundamentally because I don't believe that the government knows what it takes to revitalize an industry. I don't think we know how to restore the competitiveness of any individual industry. I don't think that is the job of the government.

In fact, it is very striking that if you actually look at the steel industry where we had, in 1984, mandated investment in that industry, we find that firms which have been investing the heaviest over the last decade are those closest to bankruptcy today. It has not been a profitable endeavor to invest in the steel industry. Yet the Congress in 1984 mandated that such investment should take place.

So I am skeptical that we really know what it takes. I also don't see why we should mandate every firm to invest. It is almost bound to be sure that some of them have to be shaken out. I say give the industry a breathing space. Give them a declining tariff, and let the chips fall where they may. It was mocked when it was implemented, but in fact that was exactly our policy with Harley Davidson in the auto cycle industry.

We gave them a tariff, we set it to decline, they knew it was temporary, and they restored their competitiveness. The market isn't perfect; it does make some errors. We can slow adjustment down. But I don't think we should do it in a detailed or interventionist way.

I think then with the revenues that we take from those tariffs that are set to decline, and indeed, from auctioning off the quotas that we currently have, we could improve our trade adjustment assistance program.

My own view is that there is indeed something very traumatic and difficult for a worker who was earning a high wage to now have to experience a precipitous decline in his or her income. Indeed, there is an incentive to delay adjustment because of that erosion in the income that that worker would experience.

My suggestion is a form of insurance, of wage insurance, for workers from such displaced and dislocated industries. If a worker were earning say $25,000 or $30,000 a year and they found a new job paying $10,000, I would suggest that they would be compensated say for half of the erosion in their wages for some period of time. That proportion could be adjusted according to their age, with older workers getting more.

But I think that easing the transition in an income sense would be an important component. I also believe that not for everybody, but where workers determine that they want to avail themselves of training, I think that that should be provided in a way perhaps that could be financed by being linked to their future incomes.

Finally, my colleague and I, in the study that we have done, believe that communities ought to have a form of assistance to deal with the traumatic experiences of plant closures. We call this a tax base insurance program.

We believe that just as we have unemployment insurance for workers, we ought to have a tax base insurance program for communities. They could insure their tax base and then, in the event of a precipitous shortfall not due to the change in the tax rate, but due if you will to a plant closure or a crop failure or a fall in the price of oil—It's a program that has wide regional applicability, not just due to trade, but due to other forms of structural shocks that hit communities.

They would then in turn be reimbursed for some proportion of the erosion of that tax base for some period of time. You could either do it on a voluntary basis, or you could make it mandatory. When you do it on a voluntary basis you have a problem, as in all insurance programs, of some kind of adverse selection, that only those who are susceptible to these disturbances would sign up. On the other hand, when we did our study we were struck by how pervasive the shortfalls have been for communities.

Our country has been racked by disturbances over the last decade. It hasn't just been the industrial heartlands. There is a broad base, a wide number of communities that have experienced this. So I think that this is a suggestion which we believe should merit further consideration.

Thank you very much.

[The prepared statement of Dr. Lawrence follows:]

Statement of Robert Z. Lawrence[1]
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before the
Technology Policy Task Force
Committee on Science, Space and Techology
U.S. House of Representatives
July 1, 1987

Industrial Transition in a Global Economy

A nation with America's human and natural resources should provide its citizens with the world's highest living standards. This proposition, once taken for granted is being called into question by many Americans. Their doubts reflect concerns that America's changing global role and the need to compete in international trade pose a threat toU.S. living standards.

America's Global Role. For most of the postwar period, the U.S. economy led the world. By almost any measure the United States economy was number one. America was richly endowed with natural resources. It had the world's most highly educated and trained labor force, the most modern plant and equipment and the leading edge technologies in almost every industry. In combination with the latest management techniques and the scale economies resulting from a huge and rich domestic market, the U.S. economy produced about twice as much per worker as its nearest European counterpart and its citizens enjoyed the world's highest living standard.

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1 The views expressed in this statement are the sole responsibility of the author and do not purport to represent those of the Brookings Institution, its officers, trustees, or other staff members.

For most of the fifties and sixties, Americans felt secure in their economic relationships with the rest of the world and in the performance of the economy at home. Between 1950 and 1973, per capita li·ing standards seemed to rise inexorably for all -- lifting large numbers of Americans from poverty. To be sure growth was punctuated by recessions and inflation presented a recurrent problem, but over the long term, faith in sustained growth proved justified and structural changes such as the shift off the farms were viewed as essential complements to progress.

But today, almost everything has changed. While America continues to have world's largest GNP and to occupy a leading position in the global economy, in several respects the American economy is no longer clearly preeminent. U.S. workers are not obviously trained in the best schools nor do they necessarily have the highest skills and work with the most modern equipment. American management may not lead in quality control, in motivating its workforce and making decisions for the long term; U.S. technology in several areas is no longer the world's best. The nation's natural resources no longer suffice to meet its needs -- oil imports are rising for the second time in a decade. America may provide its citizens with the world's highest living standards, but the lead is closer to ten rather than fifty percent.

The channels linking the U.S. with the global economy have become deep and wide and they transmit shocks in both directions. This increased global integration of the economy has been associated with a

period of much weaker domestic economic performance. The nation has been wracked with inflation, deep recessions and slow productivity growth.

America's loss of global lead, its changed relationships with the rest of the world, particularly its large trade deficit and growing international indebtedness and the nature of structural change in the domestic economy have raised questions about the future ability of the economy to sustain the rise in living standards recorded in the past. These concerns have recently reached a fever pitch in the national debate about U.S. competitiveness

In my view, America cannot ignore these changing global economic realities. Efforts to recapture the past by retreating into isolation (by erecting trade barriers, capital controls and restrictions on foreign investment) are doomed to failure. America must meet the challenge of its changing global role head on, by adapting its institutions to ensure that its competes effectively in the global economy. To accomplish this we need accurate notions of the nature of structural change within our economy and policies which aid in adjusting to it. Unfortunately, there are widespread misconceptions about the nature of U.S. structural change that may lead us astray in responding to the new global environment. The first is that there are instrinsic features of the international economy which prevent U.S. industry from competing successfully; the second is that such competition is damaging the industrial base -- that the U.S. is being

deindustrialized; the third is that the economy is shifting in an undesirable direction -- toward the production of services rather than goods and that such a shift means lower living standards, an unequal income distribution and poor jobs. In this testimony I discuss these notions. In the final section I make some brief comments about policies we should adopt to ease the adjustment burdens related to trade.

Can America Compete?

There are three popular explanations for the emergence of the large U.S. trade deficit in manufactured goods. The first appeals to the common sense notion that high-wage countries, such as the U.S., cannot compete with low-wage countries. If workers are paid twelve dollars an hour in America and less than two in Korea and both countries have access to world markets for capital and technology, firms located in Korea can always underprice those in the United States. If free trade occurs between such countries, workers in the high-wage economy face two disastrous options: unemployment or slave-level wages.

The second line of attack, the unlevel-playing field argument, appeals to U.S. national self-interest. The real world is dominated by nationalistic economic policies. The competitive, open environment assumed by international trade economists simply does not exist. Only the U.S. bases its policies on the rules of the free market. Foreign governments support targeted industries with subsidies, selective

procurement and trade protection. The result is an "unlevel" playing field and the ball inevitably bounces toward the U.S. goal.

For protagonists of both these positions the correct response to these problems seems clear: America should abandon the view that market forces dominate trade flows. It should act like other countries and manage trade to its advantage. Imports of foreign products should be strictly controlled with quotas until and unless wage levels and industrial policies resemble those of the United States. Unless we protect our markets, the argument continues, the trade deficit will balloon further and our manufacturing base will continue to shrink.

A third school ascribes the deficit to failures in U.S. manufacturing capabilities. Put simply, foreigners now make better products. Unless the United States improves its capabilities, the trade deficit will persist.

I share with these schools a deep concern with the record trade deficit, but firmly reject their diagnosis of America's trade problems:

— Since wage levels tend to reflect productivity levels, high-wage countries such as the U.S. can compete with low wage countries because their superior productivity compensates for higher wage rates. If developing countries really had U.S. skills, technology and capital levels, their wages would no longer be low.

— The gains from specializing along the lines of comparative advantage are not absent simply because government policies are more pervasive than assumed in some versions of trade theory.

— While practices such as subsidies and tariffs will affect the composition of trade over the medium run, they will not affect the size of the trade balance which is driven by a nation's spending and savings patterns. A country with investment opportunities that exceed its domestic savings will borrow from abroad and run a trade deficit even if its costs are relatively low, its home markets protected and its exports subsidized. Conversely, a nation with high savings relative to investment will run trade surpluses even if its markets are open and its products poorly regarded. By this reasoning, the recent deterioration in the U.S. trade position resulted from the decline in U.S. net national savings when the growing budget deficit was not matched by a corresponding increase in net private saving.

It is unfortunate, if understandable, that these fundamental propositions are so poorly accepted in the current environment. I will try to demonstrate the logic and empirical evidence behind each of them.

Low-wage imports. Between 1981 and 1985, the current account balance, including both goods and services, declined from a positive $6 billion to a deficit of $141 billion. The decline in the manufactured goods trade balance over the period was almost as large — $135 billion. Since the low-wage, unlevel playing field, and poor quality arguments apply particularly to manufactured goods trade, it is necessary to examine U.S. trade performance in manufactured goods more closely.

As shown in tables 1 and 2, the deterioration in the American merchandise trade balance was pervasive, across both goods and countries. As table 1 shows, between 1981 and 1986, the slump was quite uniformly and proportionately spread across capital goods (down $43.2 billion), automotive products (down $45.8 billion), and consumer goods (down $44.0 billion). Similarly, as shown in table 2, the U.S. lost trade position with each of its major trading partners over this period. Indeed, not only was the increase in the U.S. deficit roughly proportional to each partner's share of the U.S. import market in 1981, but the U.S. import shares from different trading partners have changed strikingly little. The largest shift between 1981 and 1986 was the 3.0 percentage-point decline in the Canadian share of U.S. imports. Imports from Japan (up from 25.3 to 27.4 percent) and Europe (unchanged at 22.4) grew roughly as fast as the rest of the U.S. market.

The U.S. domestic market is the location of the most pronounced competition between U.S. firms and foreign products made with cheap foreign labor. If low wages abroad were driving the American trade deficit, therefore, the share of imports from developing countries should have risen dramatically. But as table 2 indicates, the share of U.S. manufactured imports from developing countries in 1986 (25.9 percent) was about the same as the share in 1981 (25.0 percent).

Indeed, the longer-run evidence throws even greater doubt on the cheap wage argument, which implies an inexorable increase in the shares of imports from cheap labor countries. In fact, U.S. imports show

Table 1. U.S. Trade by Selected End-use Categories, 1981–86

Percent of total unless otherwise specified

Category	Exports		Imports		Change in trade balance[a] (billions of dollars)		
	1981	1986	1981	1986	Actual	Proportional[b]	Actual minus proportional
Capital goods	69.6	67.8	33.5	32.5	−43.2	−43.6	0.4
Automotive products	13.6	19.0	28.7	33.4	−45.8	−38.4	−7.4
Consumer goods	14.8	13.2	37.8	34.1	−44.0	−50.8	6.8

Source: Data for 1981 are from U.S. Department of Commerce, International Trade Administration, *United States Trade: Performance in 1985 and Outlook* (Government Printing Office, 1986). Data for 1986 are provided by Lester Davis of the ITA. Figures are rounded.

a. Change in the manufactured trade balance between 1981 and 1986.

b. The difference between what the trade balance would have been in each category if the 1981 proportions of total imports and exports had been maintained, and the actual trade balance in 1981.

Table 2. U.S. Manufactured Trade, by Region, 1981–86

Percent of total unless otherwise specified

Region	Exports		Imports		Change in trade balance[a] (billions of dollars)		
	1981	1986	1981	1986	Actual	Proportional[b]	Actual minus proportional
Canada	20.2	24.0	20.2	17.2	−14.4	−30.3	15.9
Japan	6.1	10.0	25.3	27.4	−38.4	−38.4	0.0
Europe	23.2	24.0	22.4	22.4	−32.1	−33.5	1.4
Other developed countries	8.8	8.3	5.6	5.3	−8.3	−8.3	0.0
Less developed countries	40.5	31.6	25.0	25.9	−54.9	−36.9	−18.0
Asian newly industrialized countries	5.9	7.7	13.6	15.5	−23.3	−20.5	−2.8
Centrally planned economies	1.2	2.1	1.5	1.8	−1.5	−2.2	0.7
Total (billions of dollars)	166.8	169.8	156.4	308.9	−149.6	−149.6	0.0

Source: Same as table 2. Figures are rounded.

a. Change in the manufactured trade balance between 1981 and 1986.

b. The difference between what the trade balance would have been in each region if the 1981 proportions of total imports and exports had been maintained, and the actual trade balance in 1981.

precisely the opposite behavior. In 1960, two-thirds of manufactured imports into the United States came from countries with less than half U.S. income (and wage) levels. By 1986, the share from countries with less than half U.S. income levels had dropped dramatically, to less than a third. In 1960, of course, Japan and many European countries had cheap labor by this definition; today they no longer have. If cheap labor really determined trade deficits, the U.S. should have had a much larger deficit in the 1960s when much more of the world (by economic weight) had lower relative wages than it does today.

Finally, the progressive lowering of trade barriers between developed countries was not associated with a levelling down of U.S. wages to those of foreign developed countries, but rather with a period of rapid growth both here and abroad. Moreover, instead of permanently maintaining low wages, Europe and now Japan have wages that have converged to U.S. standards roughly in parallel with levels of productivity in all these countries.

The Unlevel Playing Field. There is ample evidence that virtually all countries, including the U.S., maintain at least some restrictions on imports. Indeed, the U.S. Trade Representative publishes each year a compilation of foreign trade barriers erected around the world. Just as it has in earlier years, the U.S. should continue to pursue its negotiations with other countries to lower these impediments to trade.

Nevertheless, unfair trade practices are not the driving force behind the recent rise in the U.S. trade deficit. Whatever the slope

of the field, the trading system did not prevent the U.S. from attaining a growing surplus in manufactured goods trade between 1973 and 1981. Non-OPEC developing countries actually bought far more manufactured goods from the U.S. in 1981 than the U.S. bought from them -- the surplus was $11.6 billion

To account for the turn around of the overall U.S. trade deficit, unfair foreign practices would uniformly and suddenly have had to have changed around 1981. Indeed, something close to a massive global conspiracy should have taken place. Yet we know that protection is not much greater in the rest of the world today than it was in 1981 -- the Europeans have cut back on their industrial subsidies while the Japanese market is somewhat more open today. Indeed, as shown in table 2, the U.S. sent a larger fraction of its manufactured exports to Japan in 1986 (10 percent) than in 1981 (6.1 percent). In fact, the market in which protection has increased the most over recent times is probably the U.S. According to Balassa and Balassa, between 1981 and 1983 the proportion of U.S. imports covered by NTBs rose more rapidly and overtook that of the European Community.[2] Since 1981, the U.S. has slapped tariffs or quotas on automobiles, machine tools, motorcycles, semiconductors, and steel and has flirted in Congress with protection for shoes and wine, among other products.

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2 B. Balassa, and C. Balassa, "Industrial Protection in the Developed Countries," World Economy, vol. 7, no. 2, (June 1984), pp. 179-96.

Nevertheless, Japan continues to be frequently singled out as having the most unfair trading practices among U.S. trading partners. Yet it is doubtful that such policies were a major factor in the dramatic increase in Japan's trade surplus with the U.S. since 1981. Table 2 indicates that the Japanese share of the deficit growth is virtually proportional to 1981 trade shares. In 1981, Japan accounted for 25.2 percent of U.S. manufactured imports and 6.1 percent of manufactured exports. Given the growth in total U.S. imports since 1981, simply maintaining these 1981 shares in 1986 would have entailed a rise in the U.S. trade deficit with Japan of $38.4 billion dollars which is precisely the rise that occurred. In short, the evidence is far more consistent with the view that Japan simply picked up its share of the action than that it dramatically shifted its behavior -- the necessary requirement for the unlevel playing field explanation for the deficit.

Japanese trade balance behavior over the long run also indicates that whatever protective steps that country has taken are not causally related to its trade surplus position. Between 1965 and 1973, Japan's trade balance in goods and services (current account) averaged 1.1 percent of gross domestic product (GDP). Between 1974 and 1984 it averaged 0.7 percent. This is scarcely a record of chronic tendency towards surplus.

Poor Quality. There is considerable evidence that some U.S. products are not as good as those made by foreigners. In particular,

according to Consumers Reports this appears to be the case with U.S. automobiles. Nonetheless, such quality failures are unlikely to have become pervasive simultaneously across the wide range of goods in which the U.S. trade deficit has emerged.

The real culprit. The pervasive nature of the trade deficit — by trading partner and by product category — suggests that something aggregative or macroeconomic is at work.[3] In fact, that is precisely what has occurred. By definition, a nation's trade balance represents the difference between its total spending and production. A nation that spends more than it produces must necessarily run a trade deficit. As shown in chart 1, the U.S. has been in such a net spending situation since 1981. Between 1981 and 1986, total real U.S. spending on private consumption and investment and on government-provided services increased by 19.6 percent, or 6.4 percentage points faster than the increase in U.S. production over the same period.

One need not look far to discover what lies behind the spending-production imbalance. As shown in chart 2, between 1981 and 1986 the government sector (federal, state, and local combined) increased its annual borrowing by about $100 billion. Annual borrowing by the federal government alone exploded at an even faster pace, increasing from $64 billion in 1981 to over $200 billion in 1986. The private sector failed to increase its saving to balance the government-sector

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3 This point is also made in the 1987 Economic Report of the President, see pp.98-101.

CHART 1.

CHANGES IN NATIONAL SPENDING AND PRODUCTION: 1980 - 86

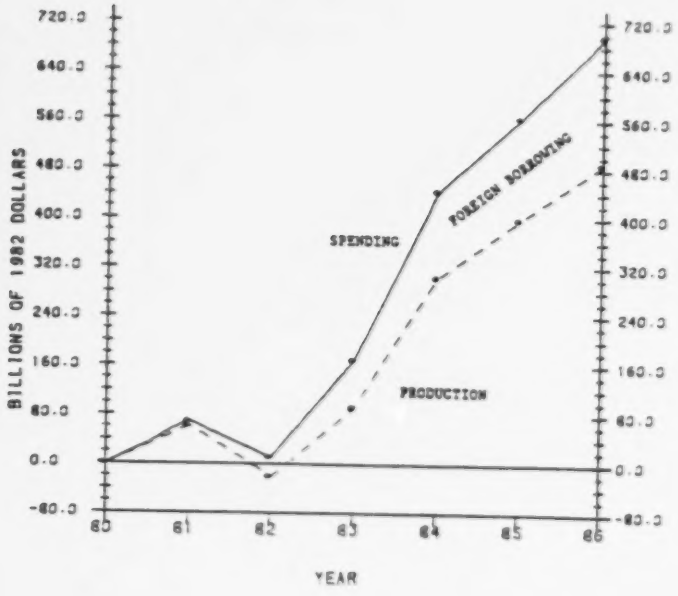
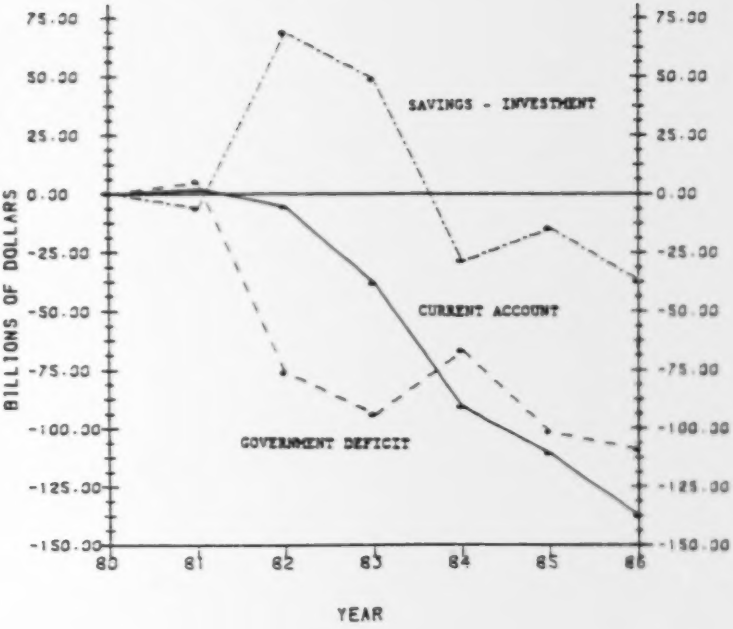


CHART 2.

CHANGES SINCE 1980



spending splurge. In fact, net private investment ran ahead of net private saving in 1986, contributing to the excess level of national spending.

In short, a fundamental imbalance between U.S. production and spending since 1981 has necessarily produced a mushrooming trade deficit. The rising dollar has been the primary mechanism inducing the trade balance shifts we have seen. Stimulated partly by high U.S. interest rates and by unsettled conditions abroad, international capital moved into the United States and caused the dollar to appreciate. This in turn priced U.S. products out of world markets. As I discuss below. How the U.S. chooses to close the gap between spending and production is perhaps the most important economic policy question facing our nation in the years ahead.

Is America Being Deindustrialized?

Newspaper headlines point almost daily to the fact that U.S. industry is in dire straights. The reports are filled with details about plant and mine closures, the plight of the rust bowl and the oil belt, huge trade deficits, and decisions by U.S. firms to locate manufacturing facilities abroad. The fear is that America is deindustrializing, that America is losing the industrial capacity required to sustain (i) the nation's role as an industrial and global power, (ii) the prosperity of important regional economies, and (iii) high-paying jobs for blue-collar workers. But these reports, while accurate for some industrial sectors, fail to convey the full picture.

They are based on a partial view of the manufacturing economy. In fact, aggregate manufacturing output has grown faster than GNP over the past five years and is expected to out-perform the economy over the next decade. America has not deindustrialised, not will it. But the nature of U.S. industry is changing. The expanding sectors reflect an age of information and technology-based growth. Among the contracting sectors in serious trouble are several major heavy industries.

"Deindustrialization" needs to be defined precisely. Does deindustrialization refer to outputs or inputs? If the concern is the nation's ability to satisfy its demand for goods, the volume of output should be the focus of attention. If the concern is the quality of employment opportunities, the demand for plant and equipment, or the adjustment difficulties associated with unemployment and plant closures, inputs such as capital and labor should serve as the focus.

Industrial Output

Spending on goods such as consumer durables and investment equipment is more sensitive to economic fluctuations than is spending on services which are less easily postponed. Consequently, goods production is very responsive to economic growth. During periods of rapid cyclical expansion (when demand is strong), manufacturing expands more rapidly than the rest of the economy. Conversely, during periods of slow growth, manufacturing performs disproportionately slowly. These cyclical fluctuations tend to cloud the stronger trend, over the

long run, for goods and services output to grow at similar rates. The estimate of manufacturing output in the GNP accounts shows America is not deindustrializing—either over the long run (1960 to 1985) or the medium run (1980 to 1985) Real value-added in American manufacturing (measured in 1982 dollars) constituted 20.4 percent of GNP in 1960, 20.9 percent of GNP in 1980 and 21.7 percent of GNP in 1985. The volume of U.S. manufactured goods production has thus kept pace, almost exactly, with the overall production of goods and services (the GNP).

The total value-added in goods in the United States, a measure which includes wholesale and retail trade margins, shows a similarly constant relationship to GNP. In 1985 the share of goods in U.S. GNP (measured in 1982 dollars) was 42.8 percent: somewhat higher than in 1980 (42.2 percent) and 1970 (42.6 percent) and similar to 1960 (43.6 percent).

In sum, therefore, judged by the volume of goods and non-residential structures in U.S. output, America is no more a services economy today than it was in 1960.

The ability of manufacturing production to keep pace with the overall production of services in the recent U.S. recovery merits comment. The abnormal nature of the recovery, in particular the huge trade deficit which emerged in manufactured goods between 1981 and 1985, might have been expected to slow the growth in goods production relative to previous recoveries. The explanation for strong manufacturing production growth, however, lies both in the abnormally

strong rise in total U.S. spending relative to GNP in this recovery and in the unusually strong rise, within total spending, in spending on goods. While real (GNP) increased by 12.5 percent between 1980 and 1985, total U.S. spending (i.e., consumption plus investment plus government spending) increased 17.6 percent (hence the decline in the real trade balance of about 5 percent of GNP in 1982 dollars). Spending on goods, however, increased by a massive 23.6 percent. In response, U.S. producers lost significant shares of the domestic market to foreigners and yet were still able to expand production volumes faster than overall GNP.

What explains the dramatic rise in U.S. spending on goods in the recent expansion? First, goods have become relatively cheap. Between 1980 and 1985, the relative price of goods declined by 7 percent--partly because the strong dollar and declining commodity prices and partly because of relatively rapid growth in manufacturing productivity.[4] In addition, U.S. spending shifted rapidly towards purchases of automobiles (which were unusually depressed after the 1979 OPEC oil shock), defense equipment, and office equipment (particularly computers). While aggregate spending on goods has been strong, it has been highly concentrated in these three categories.

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4 By contrast, over the entire decade of the 1960s and 1970s, relative goods prices declined 5.3 and 5.6 percent, respectively. The ratio of GNP deflators for goods production are compared to the overall GNP deflator is the measure of relative goods prices used here.

Industrial Output: Dollar Values

Productivity growth has been more rapid in goods production than in services production. Reflecting this higher productivity growth over the long run (although not as dramatically as in the 1980s), prices of goods have increased less rapidly than those of services. Consequently, while final demand for goods and services have increased at similar rates in volume terms, the share of goods in total dollar spending has declined. Between 1960 and 1980, nominal value added in goods production declined from 50 to 43 percent of nominal GNP; and between 1980 and 1985 nominal value-added in manufacturing fell steadily from 28 percent in 1960 to 21.3 percent in 1980 and 19.9 percent in 1985.

Employment

Faster productivity growth in goods production (rather than slower demand) is the source of the declining share of industrial employment in the economy. In 1960, 37.7 percent of working Americans had jobs in either manufacturing, mining or construction. By 1980 this proportion had declined to 33.3 percent and by 1985 to 25.6 percent. Similarly manufacturing accounted for 30.8 percent of employment in 1960, 22.4 percent in 1980 and 19.9 percent in 1985. In absolute terms, however, the manufacturing employment trend is different. Manufacturing employment increased from 16.8 million in 1960 to 19.4 million in 1970 and a peak of 21 million in 1979. In the 1982 recession, manufacturing employment slumped to 18.4 million and it has subsequently recovered to the 19.4 million range in 1986. Thus, if

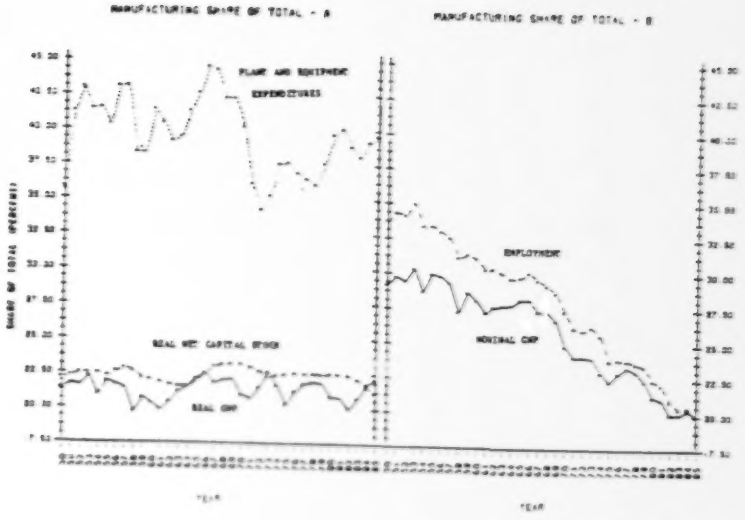
deindustrialization refers to a declining share of employment, America is certainly deindustrializing. On the other hand, over the past fifteen years absolute manufacturing employment -- although subject to considerable cyclical fluctuation -- has been roughly constant at about 20 million.

Capital

According to Federal Reserve Board estimates, both industrial and manufacturing capacity have kept pace with the volume of total production. Industrial capacity utilization was 80.9 percent in 1970, 80.9 percent in 1980 and 80.4 percent in 1985. Similarly, manufacturing output was 80.1 percent of capacity in 1960, 79.2 percent in 1970, 79.3 percent in 1980, and 80.1 percent in 1985. A second measure of the industrial base is the stock of industrial capital, i.e., a measure of aggregate manufacturing plant and equipment. The manufacturing capital stock has grown as rapidly as the overall U.S. capital stock. Real net manufacturing capital constituted 22 percent of total nonresidential capital in the united States in 1960, 22.5 percent in 1980 and 21.1 percent in 1985. Manufacturing has also accounted for a fairly constant share of total nonfarm business expenditures on new plant and equipment: 33.4 percent in 1960, 34.8 percent in 1970, 35.7 percent in 1980 and 36.1 percent in 1985.

Chart 3 highlights the major data series used in this analysis. As panel A indicates, judged by (1) the growth of real value-added in manufacturing, (2) the manufacturing capital base, and (3) the plant

CHART 3.


MANUFACTURING SHARE OF TOTAL - A
MANUFACTURING SHARE OF TOTAL - B
PLANT AND EQUIPMENT EXPENDITURES
REAL NET CAPITAL STOCK
REAL GNP
EMPLOYMENT
NOMINAL GNP
YEAR
YEAR

and equipment expenditures of the manufacturing sector, the role of manufacturing in the U.S. economy today is as important as it has been for the past twenty five years. As Panel B indicates, judged by the share of employment and nominal value-added in manufacturing, the role of manufacturing has declined significantly. From the perspective of suppliers of plant and equipment, manufacturing's role in employment is irrelevant, and while the share in nominal value-added could be important, its long-run decline has not diminished the manufacturing sector's share in spending on plant and equipment.

The Services Economy

The process of economic development is often referred to as industrialization, but judged by employment patterns it could be more accurately described as a transition to services. Even during the early period of U.S. industrialization, for example, employment in services increased as rapidly as employment in goods-producing industries. Between 1850 and 1900, employment in goods and services industries in the U.S. increased at similar rates. Between 1900 and 1950, both goods and services industries increased their shares of employment, but the services share grew more rapidly. Since the early 1950s, however, the share of U.S. employment in goods production has declined steadily.

This shift will continue in the next decade. According to U.S. Department of Labor projections in 1995, 74.4 percent of the American

labor force will produce services (compared with 72.3 percent in 1984), while only 17.2 percent will be employed in manufacturing.[5]

The implications of the emergence of service economies is hotly debated. In particular, a concern exists that the reduced role for manufacturing in the economy will threaten national well-being. Ultimately, many service jobs depend on the existence of manufacturing activities; therefore, an eroding industrial base will eventually threaten services employment. Manufacturing, some argue, is a vital source of productivity growth of middle-class incomes and the demand for capital goods.

The U.S. experience indicates that that these arguments seriously misinterpret the evidence. First, as I have just shown, increases in services production have not come at the expense of goods production. To the degree that the production of services depends on the production of goods, therefore, they have not been negatively affected by recent trends. Moreover, although increased demand for services by manufacturing firms is one of the reasons for the expansion of services, far more important is the demand by final consumers and by other services.

Second, the declining employment share of goods production primarily results from the relatively faster increases in output per worker in goods industries. Just as rising farm productivity increased

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5 U.S. Department of Labor, Employment Projections for 1995: Data and Methods, April 1986, Bulletin 2253, p. 27.

food production while freeing farm labor for employment in factories, so relatively rapid growth in manufacturing productivity is increasing goods production while making a larger share of the labor force available for employment in services. Since goods production is expanding as rapidly as services production (measured in constant prices), the relative weights--and thus relative contributions of productivity growth in each sector to overall national productivity growth--have not changed.

Third, the stylized *image* of structural change in the United States is represented by the displaced steel or automobile worker forced to take a menial job in fast foods or electronic assembly. This picture has sounded alarm bells and produced dire forecasts about the future of the middle class. Even sophisticated analysts believe that, as the economy shifts away from basic manufacturing and toward high-technology and service industries, the number of mid-level jobs will decline.

Commentators have advocated protectionist trade measures and selective industrial policies to prop up basic manufacturing and to forestall the structural economic changes that they see threatening the middle class.

But neither these presumptions nor prescriptions are correct. One cannot get an accurate picture of structural change by looking at just a few sectors or relying on anecdotal evidence. The auto and steel industries have received a lot of attention, but even at their 1979 peaks, they accounted for only 1.1 percent of total employment.

Data on sectoral earnings tell a different story. In table 3, the usual weekly earnings of full-time workers in 1959 and 1983 have been grouped by sector and divided into three classes.[6] Middle-class earnings are defined with reference to earnings of the median male ($379 a week or $19,708 a year). Jobs paying plus or minus a third of this level are considered to be middle-class.

Contrary to the common perception, the proportion of full-time workers with middle-class earnings in the production of goods is exactly the same as the proportion of workers with middle-class earnings in the rest of the economy — 46 percent. Durable-goods manufacturing does rank second among all sectors in the proportion of its workers receiving middle-class earnings (50 percent). However, the public sector has the most intensively middle-class work force (55 percent), and in third place is the services sector: transportation, communications and public utilities (49 percent). There is virtually no difference between the proportions of middle-class earnings in nondurable manufacturing (44 percent), finance (43 percent), and miscellaneous services (43 percent).

Manufacturing may provide a larger share of middle-class jobs than the rest of the economy. But it scarcely represents the backbone of the middle class. If all manufacturing workers were to be re-employed with earnings patterns typical of the rest of the economy, the

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6 For a more complete analysis, see Robert Z. Lawrence, "Sectoral Shifts and the Middle Class," Brookings Review, Fall 1984, pp. 3-11.

Table 3. Earnings Distribution across Sectors, Categorized by High, Middle and Low Earnings, 1969, 1983[a]

Percent

Sector	Distribution in 1969								
	Total			Males			Females		
	High	Mid	Low	High	Mid	Low	High	Mid	Low
Total	20	50	30	28	56	16	5	39	56
Goods producing	21	53	26	26	58	16	2	38	60
Agriculture	5	25	70	6	26	68	0	16	84
Mining	32	53	15	35	52	13	1	56	44
Construction	32	50	18	33	49	17	5	57	38
Manufacturing	20	55	25	26	62	13	2	38	60
Durables	22	60	18	27	62	11	3	49	48
Nondurables	15	49	36	23	60	17	2	28	71
Services	17	45	38	27	54	19	3	33	64
Transportation, communication, and public utilities	23	61	16	28	62	10	4	55	41
Trade	15	43	41	23	54	23	2	25	74
Finance, insurance, and real estate	22	45	33	40	48	12	4	42	54
Private households	2	9	89	5	26	70	2	7	92
Miscellaneous services	15	42	43	28	49	23	4	37	59
Public sector	24	56	20	34	56	10	12	56	32

Sector	Distribution in 1983								
	Total			Males			Females		
	High	Mid	Low	High	Mid	Low	High	Mid	Low
Total	21	46	33	30	47	23	7	44	49
Goods producing	24	46	30	30	48	22	6	42	52
Agriculture	3	27	69	4	28	68	1	21	78
Mining	48	42	9	53	40	8	28	55	16
Construction	28	45	27	30	45	25	6	51	42
Manufacturing	23	48	29	31	51	18	6	41	53
Durables	26	50	24	32	51	17	7	49	44
Nondurables	19	44	37	28	51	21	5	36	61
Services	19	42	40	30	43	27	6	40	54
Transportation, communication, and public utilities	36	49	15	43	45	12	14	58	27
Trade	14	38	48	21	44	35	3	28	69
Finance, insurance, and real estate	22	43	35	44	39	18	7	46	48
Private households	2	8	90	2	18	80	1	7	92
Miscellaneous services	16	43	41	28	41	31	7	44	49
Public sector	23	55	23	32	53	15	12	56	32

Source: Bureau of Labor Statistics unpublished data, Usual Weekly Earnings of Employed Full-Time Wage and Salary Workers, 1969, 1983.

a. Income categories established using median male weekly earnings of $142 in 1969 and $379 in 1983 as a middle benchmark. The categories are defined as follows:

high (1983) = $500+
mid (1983) = $250–499
low (1983) = $0–249

high (1969) = $187+
mid (1969) = $94–187
low (1969) = $0–93

aggregate distribution of earnings would change very little. The number of workers receiving upper-class and middle-class earnings would decline by only 3 percent and 1.7 percent, respectively.

A similar analysis with a slightly different data base refutes the contention that the high-technology industries offer relatively few middle-class job opportunities. The proportion of middle- and upper-class jobs for both males and females is higher in high-tech than in the rest of manufacturing. All of the major high-technology industries (chemicals, electrical and nonelectrical machinery, aircraft and instruments) have smaller shares of lower-class jobs than the rest of manufacturing. All of the major high-technology industries (chemicals, electrical and nonelectrical machinery, aircraft and instruments) have smaller shares of lower-class jobs than the rest of manufacturing and almost all of them have larger shares of upper-class jobs. The overwhelming source of the shift in employment to services economy is the relatively more rapid growth in productivity in goods production. The shift is thus a sign of greater prosperity rather than the reverse. As I have shown above, increases in services production have not come at the expense of goods production. Just as rising farm productivity increased food production while freeing farm labor for employment in the factories, relatively rapid growth in manufacturing productivity is increasing goods production while making a larger share of the labor force available for employment in services.

The United States is already a services economy. Only 25 percent of the workforce today produce goods. This shift has progressed so far that to understand the implications we have only to look around us. The advent of this expansion reflects advances in technology and productivity that enable us to meet the demand patterns of a high-income population. Public policy should not try to hinder this transition, but it may try to aid those displaced.

Some Suggestions for Policy

Over the past two years, there has been a substantial decline in the U.S. dollar. With time, this fall will effect an improvement in the trade balance, and alleviate many of the current protectionist pressures. Nonetheless, the dollar's fall is not a panacea. Its decline will reduce the purchasing power of American consumers. But the day of reckoning from the excess consumption enjoyed thus far in the 1980s cannot be postponed forever. The only way the nation can compensate for an erosion in the value of the dollar is to raise productivity levels. It is encouraging that both political parties now are concentrating on the issue and considering policies to bolster educational and retraining efforts as well as R&D spending. In addition, the dollar's fall should be accompanied by shifts in both U.S. spending and trade policies. An effective policy must be capable not only of reversing national over-spending without damaging investment, but also of holding protectionist pressures at bay during the potentially difficult transition to smaller trade deficits.

Shifting National Spending Patterns. The imbalance between national spending and production can be corrected in any one, or a combination, of three ways.

The first option -- reducing private investment -- is the least desirable. At a time when U.S. firms are facing severe competitive pressures, America must, if anything, increase rather than lower its rate of investment. In the absence of higher domestic savings, however, the decline in the trade balance and the associated net inflow of foreign capital, could initiate higher real U.S. interest rates and crowd out domestic investment.

The second course -- increasing private savings -- is far more desirable, but not readily susceptible to changes in government policy. After decades of empirical studies, it remains unclear whether savings patterns are sensitive to changes in interest rates and, if so, in what direction. Moreover, one of the main advertised benefits of the 1981 "supply-side" cut in personal income tax rates -- higher private saving-- has failed to materialize. Net personal saving stood at 7.5 percent of personal disposable income in 1981. By 1985, the personal savings rate had fallen to 4.6 percent -- the lowest level since 1949!

The third option -- substantial reduction of the government deficit, and in particular, the federal budget deficit -- is by far the most feasible, if politically difficult. Although macroeconomists may disagree about the desirability of completely eliminating the federal deficit, there is a broad consensus that the deficit must eventually be

brought down significantly from its current $150-200 billion range to something on the order of $50 billion. There is also consensus in the policymaking community that deficit reduction should take place gradually and, if the need arises, temporarily halted or even reversed if the economy slides into recession.

Resisting Protection. Reversing overall trade patterns will not only be politically difficult, but also will take time. In the interim -- during which the trade deficit may come down but still hover in the $100 billion range-- there will be continuing political pressure to embrace protectionist measures. Indeed, despite its free trade rhetoric the Reagan administration has resorted increasingly to protection in the worst way possible -- by using quotas and sanctioning the creation of cartels.

A major reason why even an administration as philosophically committed to free trade as the present one has found it necessary to cave in to pressures for protection is that the two "safety valves" in our current trade regime for absorbing protectionist pressures are imperfect.

The first, the so-called "escape clause," allows domestic industries to receive temporary protection from imports when they can prove to the U.S. International Trade Commission (ITC) that imports threaten or cause them serious economic injury. Although this provision of U.S. law has been reasonably effective in screening out the most unworthy domestic industries of temporary assistance --roughly

40 percent of all applicants since the law was last revised in 1974 have been denied relief by the ITC — it nevertheless has a fatal flaw. An industry can "win" its case before the ITC but still be denied relief by the President, thus encouraging it to run to Congress for permanent protection (as the domestic shoe and copper industries have done in the last two years). In addition, the law has allowed the President to provide temporary import relief in the form of quotas as well as tariffs; the latter are less distorting of trade flows and also raise revenue for the government (unlike quotas).

The second "safety valve," trade adjustment assistance (TAA) for firms, workers, and communities adversely affected by significant import competition, has been rendered increasingly ineffective because its funding has been severely cut back over the past five years. Moreover, even in its heyday, TAA delayed adjustment, particularly by displaced workers who were merely given extended unemployment compensation payments without being positively encouraged to find alternative employment.

In a recent study, which I have written with my colleague, Robert E. Litan, we have proposed several modifications in both the Escape Clause and the TAA programs which we believe would make them more useful.[7] First, the provisions of the U.S. escape clause would be

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7 See Robert Z. Lawrence and Robert E. Litan, Saving Free Trade, (Washington: Brookings, 1986). Our views are shared in another recent study of the escape clause and trade adjustment assistance mechanisms. See Gary Clyde Hufbauer and Howard F. Rosen, Trade Policy for Troubled Industries (Washington, D.C.: Institute for International Economics, 1986).

more cost effective if declining tariffs were the sole form of temporary import relief for industries seriously damaged by import competition. In addition, all existing quotas and other quantitative restrictions should be converted to their tariff equivalents by auction; that is, all rights to import products within quota ceilings should be sold off to the highest bidders. Tariff rates should then be scheduled to decline over time. The revenue raised by these tariffs should be earmarked for assisting workers adversely affected by imports.

Second, we recommend that an affirmative injury finding by the International Trade Commission (ITC) automatically trigger two different types of relief. Mergers of firms in beleaguered industries (not protected by quotas) would be assessed under liberalized standards, as recently recommended by the Reagan administration. If an industry is judged by the ITC to be seriously damaged by imports, then there is little worry that mergers will lead to imperfect competition.

We also recommend that trade adjustment assistance automatically be extended to displaced workers, but only in such a way that the benefits provided encourage rather than delay adjustment. Specifically, we propose that the primary component of TAA benefits consist of insurance against loss of wages. That is, workers displaced by import competition would be compensated for some proportion of any reduction in wages they may experience in obtaining new jobs, thereby encouraging those workers to find and accept new employment quickly.

The proportion of the loss compensated could vary with the age of the worker and seniority in his or her previous job. A second component would provide extended unemployment compensation to workers residing in regions where the unemployment rate significantly exceeds the national average. The remaining elements in our proposed program would provide relocation allowances and assistance for retraining. Federal loans for retraining would carry repayment obligations tied to future earnings and collected automatically through the income tax system.

Even under highly conservative assumptions our proposed program of trade adjustment assistance could be readily financed for at least a decade by converting existing quotas into declining tariffs. As a result, there would be no financial pressures to impose new tariffs to fund the assistance program, although the president would still be authorized in the future to grant tariff remedies to domestic industries proving to the ITC that they merit relief.

Finally, we propose a new mechanism to ease the pain of economic dislocation for communities -- a voluntary system of insurance by which municipalities, counties, and states can protect themselves against sudden losses in their tax bases that are not the result of reductions in tax rates. Under such a program, governmental entities choosing to participate would pay an insurance premium, much like the premiums firms currently pay for unemployment compensation, for a policy that would compensate for losses in the tax base caused by plant closures or significant layoffs.

In sum, we will not be able to reverse our trade balance until our national spending patterns change. But in the meantime, we must do a far better job in easing the difficult dislocations caused by the persistent trade imbalance and the normal shifts due to structural change.

Mr. MACKAY. Thank you.
Mr. Strassmann.

STATEMENT OF PAUL A. STRASSMANN, RETIRED VICE PRESIDENT, XEROX CORP.

Mr. STRASSMANN. The subject of technology policy is vast. I would like to concentrate my remarks entirely on that technology that affects 56 percent of the workforce, which earns 67 percent of all labor wages in the United States. That workforce is the white collar, so-called information workforce.

My subject concerns the computerization, the rapid injection of technology into that workforce. What distinguishes that workforce is that computerization if singularly dominant and perhaps the only tool which is applicable to affecting the productivity of that workforce.

Now, the evidence that I will present here today is that the productivity of the most technologically impacted workforce—namely, the information workers—has been declining steadily since 1974 since the United States has engaged in a massive investment program in computers. In fact, at this juncture one-third of total products durable—products durable are the tools by which we improve productivity—one-third of all of those investments are being channelled into computerization.

Consequently, it would be the purpose of any technology policy to ask whether one-third of our most valuable and most advanced resources are really delivering to the economy the kind of advantages which we expect and which we need in order to maintain full employment, as suggested by Dr. Ginzberg and as suggested by Dr. Lawrence, to achieve productivity so that our revenues and our expenditures match.

With that introduction, suggesting perhaps that the subject of computerization deserves the interest and the attention of the Technology Policy Task Force, I would like to then go over some of the past history of Congressional involvement in information technology. I would suggest to you that all of the past concerns, which mostly concentrated on issues of privacy, protection, standards and so forth, really never dealt with the cardinal issue—namely, productivity.

Therefore, bringing before your agenda the issue of productivity I think is a new agenda item. What are some of the reasons why we are starting to have doubts about information technology and its effect on productivity? I think that the recent issue of Fortune Magazine, which highlighted its story by the headline "The Puny Payoff From Office Computers," certainly brought to public consciousness that there are some doubts.

Monday this week, the New York Times had a key article in the business section which was "High Technology is Hampering the Service Industries, Productivity Declining." So my concerns that I'm bringing before you are not just spurious. I think they are starting to become very topical, and I think they will be elevated on the public agenda very rapidly.

Now, let me just talk about the importance of computers in office automation in the area of high technology. 90.4 percent of all high

technology capital investments are going to computers. Of that, about 85 percent is really being channelled into the information sector. Let me repeat—computerization is being selectively channelled to the information sector.

The information sector, by the way, as I define it is basically the overhead of this economy. It is not the direct workers—the factory workers, the steel workers—that I am concerned here with. I am concerned about the professionals, the executives, the managers, their secretaries. I am concerned about Congressmen and their staff.

Mr. MACKAY. Let me just interrupt you to say that you've just described a phenomenon that all of us have experienced. The more computers, the less we get done. We thought it was just the Congress.

Mr. STRASSMANN. Nevertheless, from the standpoint of technology policy, that raises some serious issues. If we are betting on this tool and this superior technology to achieve the balance between our ability to earn money and to spend money, then the question of what are the causes and the underlying driving forces that after approximately $1.8 trillion worth of expenditures for computers—which I understand even by Congressional standards is a non-trivial amount—we are unable to demonstrate superiority from this technology.

My testimony lists in the footnotes about a number of studies that echo my findings in this field. I just want to highlight the study that I have been engaged in in the last five years, where I have been very much concerned about the underlying issue of how do you measure productivity in the white collar sector, a subject of great concern to all academics and foundations.

Let me just tell you that I have discovered that you cannot look for the causes in underlying understanding what is happening by looking at macroeconomic statistics. They are practically useless for that purpose. You have to go down to the microeconomic environment and study on a firm by firm basis why some firms are productive and why some firms are not productive.

Without boring you with details—and I have written a book about the subject—let me just give you the highlights of my findings. When I studied the companies, I discovered that if you plot productivity against the amount of information technology they use, if information technology would indeed enhance productivity you would find that more information technology would plot against improved productivity. Well, that's not the case.

When you plot information technology versus productivity, the scatter diagram is random. You can generate it by throwing darts. What is interesting, however, and what is important in my opinion to the Technology Policy Task Force, is that when you then focus on those firms who have high productivity and use computers and those who use computers and have low productivity, you suddenly discover that many other factors come forth as being dominant. Then computerization becomes actually supportive, to either accentuate lack of productivity or accentuate superior performance.

In a nutshell, what I have discovered is that the underlying phenomenon that is driving the lack of productivity of America is the bureaucratization of America. We are basically moving people from

productivity gaining jobs in manufacturing into jobs where they are losing productivity.

Anytime you do that and when you do that on any big scale—and certainly you have moved now 57 percent of your workforce into paper pushers—you are going to get the economic results that everybody is observing. And by the way, without detracting from the forthcoming testimony about employment, one of the reasons we have had increases in employment is because we have been shifting people into unproductive jobs. You generate jobs, although lowering the standard of living, by moving people from productive jobs to unproductive jobs.

What does this mean and what should be done by the Technology Policy Task Force about this phenomenon? First, I suggest that the current policy analyses available to the Congress are almost entirely focused on the production sector of the economy, which is the traditional legislative base for passing legislative measures. There has been an insufficient attention given to the economics, particularly the technological economics of the information workforce.

Therefore, I suggest that many of the technology policy options mentioned by your staff people—like tax policy, cost of capital, technology transfer, job protection, plant closing, what have you—in fact may not be applicable, and most likely are not applicable to the white collar sector of the economy.

Now, what can then be done? My belief is that first, the impact of Federal and Congressional legislation on bureaucratization of America should be understood and should be made evident. Let me just tell you a small example that I've taken in the current tax law in order to increase revenue. A very elaborate provision has been made to not allow the deduction of inventoried costs. You have to allocate costs of inventory in management and then capitalize it and then retrieve it.

I am an experienced computer executive. For the firm that I worked for, that would represent a minimum of half a million dollars of just conversion-programming expense on computers, and another $100,000 worth of annual expense. I mean, if you multiply that, there goes a billion dollars. Just administrative costs.

It is my opinion that in the same way as industry is being called on to file environment impact statements, the Federal and Congressional deliberations ought to be subject to a productivity impact statement, In the deliberations to raise taxes and so forth, I think some consideration should be given to how many lawyers it will employ and what will be the consequences.

I can employ computers to do this computation of capital appropriation and capital allocation very efficiently. But every time you are asking me to complicate my business, I am going to decrease productivity in this USA.

The second recommendation that I have is that the National Science Foundation, that has so far not been very much concerned with the subject of microeconomic analysis of the relation between computerization and productivity, should be encouraged to make a major investment in trying to find out what are the underlying causes and factors that affect the relationship between productivity gains and losses by the information workforce.

I think focusing on the information workforce and computerization is a high agenda item that has not been given sufficient attention.

Lastly, of course, the Congressional realization that bureaucratization is our disease. It may be helpful in contributing to a renaissance in our productivity.

Thank you very much.

[The prepared statement of Mr. Strassmann follows:]

U.S. House of Representatives

COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

PRODUCTIVITY OF INFORMATION WORKERS & COMPUTERIZATION:

THE EFFECT OF TECHNOLOGICAL CHANGE ON THE LABOR FORCE:

HEARINGS BEFORE

THE TECHNOLOGY POLICY TASK FORCE

Rayburn House Office Building, Washington, D.C.

July 1, 1987

Testimony by:

Paul A. Strassmann
STRASSMANN, Inc.
New Canaan, Connecticut

INTRODUCTION AND DEFINITION OF SCOPE

Mr. Chairman and distinguished members of the Committee. My name is Paul A. Strassmann. I am a retired business executive and university professor. My 1985 book *INFORMATION PAYOFF - Transformation of Work in the Electronic Age* has been well accepted in the USA. This book is also published in Japanese, Brazilian and Russian translations.

My career since 1953 involved managing and planning the installation of computers for three very large U.S. multinational corporations. My last position was as Vice-President of the Information Systems Group of the Xerox Corporation, with worldwide responsibility for strategic planning and evaluation of information systems.

I understand that your Task force examines "...the many factors that must come together to advance America's technological efforts." You also wish to address deeply rooted causes rather than hear a recitation of symptoms. Lastly, your wish to examine how current Federal policies and practices may work to U.S.national advantage.

*** To deal with the complexity of your agenda this testimony will focus entirely on the effects of computerization on the productivity of the "white collar" segment of the USA workforce.**

*** The testimony will concentrate on the lagging productivity growth caused by "information workers." The future performance of information workers is decisive in delivering to us real growth in income per capita. Increasing their productivity is essential for the creation of added wealth which is ultimately needed to support increased employment.**

*** The overwhelming concentration of computer investments within the "information sector" of the U.S. economy remains as the primary technological means for improving the productivity of our executives, managers, administrators, professional workers, sales persons and clerical workers. This personnel accounts for 56% of the workforce and for an estimated 67% of all labor costs.**

Therefore,

*** Any new Federal policy concerned with the uses of technology should be also examined whether it supports the productivity-enhancing effects of computers.**

In this presentation I shall not deal with the effects of computer technologies in the factory environment. This has already received adequate attention in a report by the Congressional Office of Technology Assessment[1].

I shall concentrate on the effectiveness of our information workers because they make all the key decisions on innovation, product development, pricing, marketing and capital investment. They also generate almost the entire burden of overhead expenses that the manufacturing sector must add to its cost base. The information workforce, because of its size and influence is decisive in shaping the economic viability of the U.S. Their use of the overwhelming major share of the total computer capacity is indispensable in the application of any other U.S. technology. Therefore,

> **• The relationship between computer technology and the productivity of information workers[2] merits the concentrated attention by the Technology Policy Task Force.**

This discussion deals not only with government, banking, insurance, professional services and health industries, but will also include all personnel in manufacturing, transportation and trade organizations concerned with the creation, processing and the generation of information. It includes all management and professional personnel along with their supporting administrative, clerical and secretarial staffs who have been subject to massive office automation in the last decade.

We shall cover the pivotal issue of actual productivity accomplishments to add to a prior Congressional exploration on this subject.[3] Most of the ideas presented here have been included in my report to the 1983 White House Conference on Productivity[4] and in the chapter[5] on profitability of computer investments in my book.[6]

In this testimony I shall suggest the following:

> **• If the Technology Policy Task Force is seeking out deeply rooted causes for the lack of information worker productivity, they are not caused by inadequate investments in computer technology.**
>
> **• Any lack of productivity should be first traced to non-technological influences. There is no indication that technologically deficient computers are the source of unfavorable productivity results. Escalating costs in incurred in managing U.S organizations -- even if computerized -- are the causes of declining productivity.**
>
> **• Federal technology policies applicable to industrial problems are of questionable benefit in the information-based environment.**
>
> **• There is an insufficient base of factual evidence to deal with the socio-economic complexities of the information economy, by means of a national technology policy. Legislative measures that require ever increasing amounts of information-processing are likely to have a greater effect on information worker productivity than any other act by the Government.**

*** To stimulate productivity growth of information workers, by means of a technologically-related policy, the Technology Policy Task Force should request the National Science Foundation to initiate studies that will diagnose the sources of excellent productivity accomplishment, with special emphasis on the effects of computers and information processing costs imposed by Federal requirements. Only after having such a diagnostic capacity should consideration be given to new legislative measures.**

DOUBTS ABOUT COMPUTER TECHNOLOGY

For the first 30 years of the computer era the U.S. adopted an unquestioning attitude about the benefits to be gained from every aspect of these technologies. Except for attention to technology-related matters such as standards and potential health hazards, the primary Congressional policy concerns have always focused on matters of potential unemployment. For the third time, the most recent report dealing with this matter puts aside the question whether computerization creates unemployment.[7] The report proves precisely the opposite: despite heavy computerization new "information" jobs have grown at a steady pace.

Another intense Congressional concern of the 1970's resulted in a massive but inconclusive inquiry about adverse effects of computers on personal privacy.[8] So far, none of the public policy inquiries have resulted in the creation of a pressing need for a major legislative thrust to deal with the computerization of our economy.

*** Among the topics explored by Congress in the past three decades of the computer era (e.g. privacy, health hazards and unemployment), there is little deserving a re-examination by the Technology Policy Task Force.**

*** The previously studied matters, except for unemployment, do not qualify as "...deeply underlying and major policy issues..." dealing with the problems of productivity of information workers.**

What deserves the full attention of the Technology Policy Task Force are recent warnings that the undoubted economic gains from computerization may not stand up to examination. This new doubt was best expressed in a cover story in FORTUNE magazine with the title: *The Puny Payoff from Office Computers*.[9] The supporting headline of this article summarized the entire story: "...U.S. business has spent hundreds of billions of dollars on them /computers/, but white-collar productivity is no higher than it was in the late sixties. Getting results usually entails changing the way work is done, and that takes time..."

A similar sense of alarm can be found in the NEW YORK TIMES : *High Technology is Hampering the Service Industries- Productivity is Declining*[10]. Accordingly: "...Nearly a generation after American technology ...unleashed new computers,...executives and employees are discovering that the sophisticated machines in many cases have been hampering their work."

To understand the meaning of a "puny payoff" and "technology hampering" one has to examine the significance of computer investments. The best source of this information is the economics department of the banking firm of Morgan Stanley.[11] The following indicators from their report are noteworthy:

• Computers, Office Equipment and Communications Equipment accounted for 32.5% of all business capital equipment expenditures in 1986.[12]

• The above categories accounted for 90.4% of all business capital expenditures for "high-tech" equipment in 1986.

• 83.6% of all "high-tech" capital stock in place in the U.S. is placed in the "Information Sector"[13]

The above statistics reveal the extent of the penetration of computerization in the U.S. economy which is not approximated in any other country.[14] The very high allocation of high-tech capital stock to the information sector reveals that this phenomenon is of a recent origin. The shift of U.S. capital investments from the manufacturing sector to the information sector and from manufacturing-based producer's durables to information handling equipment has taken place mostly since 1974. What are then the consequences of such a major restructuring in the deployment of our high technology achievements?

• Total productivity of the private non-farm economy peaked in 1974 and has not recovered since then.

• Information Worker productivity in the "Information Sector" has steadily declined since 1974.

• Information Worker productivity in the "Goods Sector"[15] has declined significantly since 1974.

In the period since 1974 production worker productivity has increased both in the information sector as well as in the production sector. However, because of the higher proportion of information workers, the net effect on national productivity has been negative. The above productivity computations are based on data provided by the Bureau of Labor Statistics, which most likely understates the declining labor productivity of information workers.[16] The findings suggest some uncomfortable conclusions:

• There is no evidence that the massive infusions of information technology, in support of information workers, has generated discernible national gains in productivity.

• The net employment growth in the U.S. in the past decade comes from exceeding the decline in the number of production workers by growth in information workers.

*** The above employment trends shield that we are trading a diminished number of productivity-gaining production workers for an increasing number of productivity-losing information workers.**

*** The recent favorable employment growth among information workers may be significantly attributable to their declining productivity.[17] Consequently, the many self-congratulatory pronouncements about employment trends should be tempered by uneasiness about our living standards.**

Another source of doubts about the effectiveness of information technology comes from a study by Touche Ross International.[18] Their findings are significant because they highlight the productivity of perhaps the most intensely computerized industry. The report shows that the operating expenses of the top 50 U.S. banks exceeded revenue growth for the period from 1979 through 1983. During this period the rate of computerization of U.S. banking has proceeded at an accelerating pace.

The conclusions from interviews with senior banking executives were that "...technology has had little strategic impact in banking, despite massive investment by the industry..." These executives said that they "...are generally disappointed in the return on their technology investment in terms of their inability to use technology to achieve lasting competitive advantages vis-a-vis their competitors." The executives also said that they were disappointed in their failure to achieve expected economic returns through reduced operating costs.

So far I have been able to locate only one valid case study about the economic effects of computers dealing with the productivity of individual firms. It involves an examination of 138 wholesalers, some of whom did not use computers, some used computers moderately and some had a comprehensive level of computerization.[19] Firms with "no computer" averaged a return of 11.3%; firms with medium usage averaged a return of 9.8%; firms with heavy usage of computers averaged a return of only 8.8%.

A more comprehensive study was conducted by the Strategic Planning Institute[20]. It showed that there was no discernible correlation between the uses of information technology (in terms of technology costs divided by the value added of the firm) and the firm's return-on-investment. A similar exploration in England[21] arrived at the identical conclusions that in the service sector there is "...no evidence to support the commonly held view that computerization leads to a reduction in the information workforce.../and/ that the relationship between the use of computers and profitability level is significant."

*** The Technology Policy Task Force should consider that to realize further increases in the U.S. standard of living (e.g. gains in real income per capita) the productivity of information workers must increase.**

*** Information workers are the most costly expense category in the economy. Unless their productivity increases, it is unlikely that other policy measures can accomplish the goal of improving national productivity.**

*** Computer technology is the most plausible major capital investment that still has the potential for improving the productivity of information workers. Therefore, we need answers why computerization has hitherto not delivered favorable productivity results.**

Before the Technology Policy Task Force can consider technology policies that could favorably influence the productivity of information workers, there must be a solid basis for understanding the underlying causes behind existing productivity weaknesses. As Abraham Lincoln said: *"If we could first determine where we are ...we could more readily agree on what course to take and how to get there."*

FINDINGS ABOUT INFORMATION TECHNOLOGY EFFECTS

My own work in exploring the strengths and weaknesses of computerization derives from the concepts and techniques developed by the Strategic Planning Institute of Cambridge, Mass. The Institute has accumulated, since 1972, the most comprehensive data base with detailed information about 450 companies covering 3000 individual businesses. The Institute uses this data to explore the relationships between different business characteristics and business results. The objective is to discover patterns that would differentiate and measure the distinctions between "poor" and "excellent" companies. The Institute, in its prolific collection of research reports, articles, doctoral dissertations and books[22] has discovered new insights into the sources of favorable profit performance. The Institute has quantified the relationships between business variables such as "market share," "capital investments," "product quality," "product innovation," "marketing expenses," "R&D costs" and "return-on-investment." In many respects the work of the Institute is comparable to the pioneering work done in health sciences that led to techniques for discovery of the relationships between smoking, body weight, exposure to environmental hazards, heart disease and life expectancy.

In my capacity as the chief information technology executive of the Xerox Corporation during the 1970's I had the responsibility to justify a rapidly growing internal computer technology expense. I concluded that the traditional measure of corporate performance, e.g. ROA (e.g. return-on-assets) was not appropriate for judging the results of computerization. With "management costs" of U.S. businesses averaging over 30% of the total value-added[23] the annual expense for **managing** a business far exceeded the annual costs of assets for **supporting** the business. Therefore, I decided to measure the value of "management information systems" by evaluating their effect on the value-added of "management"[24]. This approach gave rise to a 1984-85 study by the Strategic Planning Institute on "Management Productivity of Information Technology" (MPIT). The following study findings are relevant:

*** The level of information technology expense is not directly related to management productivity. Businesses using large amounts of information technology do not deliver superior results in comparison with firms using lesser amounts of information technology.**

*** If the ratio of management expenses (e.g. overhead costs) to value added is substantially above the average, no amount of computerization will deliver improved productivity. It seems that excessive overhead**

staffs cannot benefit from computerization without first simplifying the work to be done.

*** Companies that are subject to fundamental strategic hardships, such as low market share, heavy capitalization and an inferior product quality cannot remedy their conditions principally through computer-aided management.**

*** Computers will not make a badly managed business better. The expenses for computerization and the increased rigidity in computer-managed procedures are likely to accelerate the decline of incompetent management.**

*** Computers may reduce information processing costs. However, any increase in legislatively-induced requirement for information will diminish information worker productivity, regardless how efficiently carried out.**[25]

*** Companies most likely to benefit from computer investments are those that have simplified their management, focused on improved quality, reduced their assets and introduced innovative ways of delivering value-added to customers. Such companies seem to derive great additional benefits from computers' contribution to reduced administrative expense.**

*** Strategically sound organizations benefit from computers. They spend more than twice the amount of computer expense, per capita, than companies that have a low level of productivity.**

*** The implications of these findings are clear: One should automate successes, not failures.**

*** Helping strategic failures through generic technology-related subsidies, grants and other public policy measures will not enhance the productivity of information workers. Only a highly selective application of information technology has a chance of delivering favorable results.**

HOW TO FIND "PRODUCTIVITY"?

The above findings then lead to the key question before the Technology Policy Task Force:

• How to identify the most effective productivity enhancing measures that can benefit from actions by Congress or the Federal Government?

With regard to the relationship between technology policy and the productivity of the information sector:

• Congress and the Federal Government does not, at present, have a sufficient factual basis to discriminate between the causes of high and low productivity among information workers. This lack is specially acute in the public sector, where numerous attempts at a consistent approach to measuring information worker productivity have met with little success.

• Without factual findings about the sources of productivity excellence none of the technology policy options, such as those involving tax policy; cost of capital; antitrust regulation; technology transfer; federal research directions; education at the primary, secondary or college levels; adult education; job protection etc. are likely to meet the expectation delivering better productivity results.

One should not despair about our current lack of understanding about the relationship between computer technology and productivity. The advent of the "information age" has found us conceptually unprepared to deal with the shifts needed in the way how our public institutions should act. Too much of the current policy thinking defines issues in terms applicable to the industrial era. This type of thinking concentrates on measurable physical output, the importance of plant & equipment assets, and the needs of product-oriented R&D. There is ample evidence indicating that availability of hardware, products, plant & equipment and technology are necessary but insufficient to realize improved productivity of information workers. One of the reasons for the large list of unanswered questions before the Committee on Science, Space and Technology[28] comes from a lack of answers to be found by applying the industrial age point of view. The traditional approach of the Federal government has been based on the following:

• Legislative measures should solve simple and pressing problems, one at a time.

• When in doubt, increase the amount of funds allocated to dealing with a problem.

• Whenever possible apply a technological solution, preferably in the form of sophisticated equipment.

• Make sure that all policies apply uniformly, on a mass basis, to meet average needs.

• Since the problems are presumed to be simple, uniform and homogeneous, do not spend too much time on

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diagnosis. Rely on the political process to arrive at an acceptable solution through negotiated compromise.

I doubt very much that the above patterns of policy-making will help us to increase information worker productivity. There is increasing evidence that to obtain high levels of productivity from information workers calls for supplementing uniform policies with a broad spectrum of customized measures that deal with the needs of individuals such as: gainsharing (e.g. changing the traditional basis of worker compensation); entrepreneurialism (allowing a share of compensation to accrue in the form of long term capital gains); work enlargement through computer-aided automation; participative decision-making; problem-solving management; quality circles; team building; worker self-development; on-the job training; etc. The difficulty is that even though each of the above techniques has euphoric proponents, they seem to work only if applied as a carefully balanced blend. In contrast with the traditional industrial age point of view of applying uniform policy-based solutions, the productivity of the information workforce will respond to policy approaches based on the following:

*** Recognition that simple and isolated legislative policy measures to solve complex productivity problems do not exist.**

*** Across-the-board subsidies and grants do not produce desired results. What works are incentives to reward unique cases of excellence.**

*** Manage people, not technology. Selecting, stimulating and advancing productive people is the primary means for getting results. If the achievers want computer technology, supply it provided they can support it.**

*** Make sure that all policies accommodate unique conditions and allow for individual exceptions. Resist adopting average solutions because you will always end up with below average results.**

Therefore,

*** The Technology Policy Task Force should see to it that investments are made in a comprehensive fact-finding research that would diagnose the sources of productivity excellence and productivity failure associated with the computerization of the U.S. economy.**

*** The proposed research would depart from existing studies and findings because it would explore productivity accomplishments at the micro-economic (business) level. With very few exceptions, all of the current research on matters of information worker productivity has been performed on the macro-economic basis.**

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SHIFTING TO THE MICROECONOMIC POINT OF VIEW

If productivity growth among information workers is the key to future economic growth and employment, the Technology Policy Task Force should first invest in a microeconomic assessment of the information sector. This work should not be seen as another "one shot" study ending up in a report. Conceive this effort as a continuing diagnostic program to analyze the causes contributing to favorable effects of information technology.

An organization should be found to support such diagnostic monitoring. It should collect, from a representative sample of businesses, comprehensive data which will make it possible to identify factors that are associated with superior and with inferior productivity results. To carry out such a program will require an unprecedented collection of microeconomic information.[27]

There are precedents for the involvement of the Federal Government in monitoring and evaluating detailed of information. It is less than fifty years since the inauguration of comprehensive programs to evaluate the effects of pharmaceuticals. Assessing the effects of environmental hazards began less than thirty years ago. Monitoring conditions affecting occupational health has become acceptable as a Federal activity recently.

> *** Information technologies are beginning to have a similar complex effect on the productivity of our society as pharmaceuticals have on health or insecticides have on ecological balance.**
>
> *** The methods for dealing with the long-term productivity effects of information technologies may have to borrow from the methods learned about unexpected interactions between pharmacology and health.**
>
> *** There is a danger that the traditionally disjointed approaches to regulation through legislation, on an isolated case-by-case basis, will upset the delicate balance between easily articulated social concerns and inadequately understood economic consequences.**

Isolating the legislative agenda into topical issues, one at a time, such as ergonomics, occupational stress, privacy, paperwork reduction, regulatory simplification, transborder data flow, copyright protection, export control, technological disclosure, work-at-home constraints, literacy, adult education, plant closing notification, wage structure, procurement policies, hiring quotas, etc. may be an acceptable way of dealing with real problems experienced by individual groups. The cumulative effects of each such desirable measure on productivity may be totally unpredictable if not adequately understood. Therefore:

> *** U.S. technology policy concerning computerization of the economy should be always examined in terms of evidence what will increase the productivity of the information workforce.**
>
> *** U.S. Congressional and Governmental proposals requiring increases in data requirements from the**

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private sector should be accompanied by a "Productivity Impact Statement" which shows the total incremental life-cycle costs of the proposed measure.

SPECIFIC ACTION RECOMMENDATIONS

*** Within programs of the National Science Foundation allocate adequate funding to a micro-economic, business level, research program that will evaluate the factors affecting the productivity gains and losses by the information workforce.**

*** Require that this diagnostic program provides continuing evaluations of which mix of technology, economic, social and legislative influences are demonstrably associated with enhanced productivity by the information workforce.**

*** To test the Congressional impacts on information worker productivity commission a study of full life cycle costs, gained or lost, in information processing expenses associated with the implementation of the Tax Reform Act of 1986 in order to demonstrate its effect on information worker productivity.**

NOTES:

[1] U.S. Congress, Office of Technology Assessment, *Computerized Manufacturing Automation: Employment, Education and the Workplace*, Washington, D.C. OTA-CIT-235, April 1984.

[2] U.S.Department of Commerce, Office of Telecommunication, *The Information Economy*, OT Special Publication 77-12 (Vol.1-7), May 1977

[3] U.S. Congress, Office of Technology Assessment, *Automation of America's Offices*, Washington, D.C.CIT-287, December 1985.

[4] White House Conference on Productivity, *Productivity Growth - A Better Life for America*, National Technical Information Service, PB 84-159144, April 1984 and especially in a companion volume, *Report of the preparatory conference on Private Sector Initiatives*, which has a section summarizing the recommendations what to do about information worker productivity.

[5] Paul A. Strassmann, *Information Payoff - The Transformation of Work in the Electronic Age*, The Free Press, New York, 1985, pp. 151-164

6 Part of the text of this testimony comes from a research paper sponsored by the International Center for Information Technologies : Paul A. Strassmann, *Measuring Business Value*, International Center for Information Technologies, Washington, D.C.: to be published in October 1987.

[7] Panel on Technology and Employment; Committee on Science, Engineering and Public Policy, *Technology and Employment - Innovation and Growth in the U.S. Economy*, National Academy Press, Washington, D.C.: 1987

[8] Privacy Protection Study Commission, *Personal Privacy in an Information Society*, U.S. Government Printing Office, Washington, D.C.: 1977

[9] William Bowen, *The Puny Payoff from Office Computers*, FORTUNE, May 26, 1986, p.20

[10] Keith Schneider, *Services Hurt by Technology - Productivity is Declining*, THE NEW YORK TIMES, June 29, 1987, p.D1

[11] Stephen S. Roach, *The Technology Slump: Dim Prospects from the Bottom*, Economics Perspectives Memorandum, Morgan Stanley Economics Department, New York, N.Y. March 11, 1987, 14 pp.

[12] According to the Computer and Business Equipment Manufacturers Association the share of computer and business equipment in producer's durables has increased from 36.4% (or $ 37.2 billion) in 1975 to 41.6% (or $ 123.9 billion) in 1985. This is now projected to become 44.2% (or $ 280.5 billion) in 1995. For details see Graph 2-7 in CBEMA Industry Marketing Statistics, *The Computer, Business Equipment, Software, and Telecommunications Industry 1960-1995*, CBEMA, Washington, D.C. 1986

[13] Defined here as Communications; Finance; Insurance; Real Estate; Services and Wholesale and Retail Trade industries.

[14] Data for reliable international comparisons are lacking. Based on frequent personal experiences with computerization in Japan I venture to say that their business expenditures for computerization do not approach our ratio (as a % of total business capital expense). Most importantly, Japan does not allocate its computer investments overwhelmingly to the information sector.

[15] The "goods sector" is defined here as the construction; mining and manufacturing. For further details about definitions see Roach, op. cit

[16] The existing methods for computing productivity in the information sector do not adequately recognize the rapidly increasing costs of capital. According to methods suggested in my book, the contribution of capital costs to productivity must be subtracted before arriving at net labor productivity.

[17] This conclusions follows from output growth for the period from 1982 through 1986 (see Roach, op. cit.). During this period the output growth in the goods sector was 18.2% and in the information sector 19.1%. Their respective employment growth gains were 7.6% and 15.1%. It should be clear from these ratios that

the better productivity performance of the goods sector is attributable to its much slower rate of job creation than is the case with the information sector.

[18] Touche Ross International, *The Impact of Technology on Banking*, Touche Ross & Co. New York, N.Y. 1985

[19] W.L.Cron and M.G.Sobol, *The Relationship between Computerization and Performance*, INFORMATION & MANAGEMENT JOURNAL, Elsevier Science Publishers, Vol.6 (1983)

[20] As reported in Strassmann, op.cit. pp.159-162. An independent researcher examined the identical data base and concluded that "...the estimated productivity of information technology capital is rather modest. These estimates show low productivity vis-a-vis both non-computer capital and R&D capital. This somewhat lackluster performance of information technology is in stark contrast to the technology's well known capabilities." See Gary W. Loveman, *The Productivity of Information Technology Capital: An Econometric Analysis*, Ph.D. Dissertation, Department of Economics, Massachusetts Institute of Technology, January 1986.

[21] C.S.Yap and G.Walsham, *A Survey of Information Technology in the U.K.Service Sector*, INFORMATION & MANAGEMENT JOURNAL, Elsevier Science Publishers, Vol.10 (1986)

[22] Summarized in R.D.Buzzell & B.T.Gale, *The PIMS Principles - Linking Strategy to Performance*, The Free Press, New York, 1987

[23] "Management" is defined here as all costs associated with planning, coordinating and administering a business. It roughly approximates the accounting definition of "overhead" or indirect expenses. Thus it would include not only the payroll costs of executives and managers, but also the expenses for all supporting staffs (such as secretarial and clerical labor), office space, outside purchases, etc.

[24] Computerization of U.S. factories consumes a small share of computer costs. Based on overall productivity numbers, quoted before, the computerization of manufacturing is not a source of declining productivity. The installation of a factory-floor computer is also much easier to justify, since it can be considered as a machine tool.

[25] The examples of added burdens are too numerous to be listed exhaustively. Their effect is cumulative but systematic in increasing the requirement for added overhead staffs and added computer processing power. For instance, the Tax Reform Act of 1986 requires companies with sales of more than $10 million to record inventory related expenses -- such as purchasing, handling and warehousing -- and add them to the cost of inventory. These capitalized expenses can't be deducted until the inventory is sold (Also see *New Inventory-Expense Rules Increase Costs at Many Firms*, WALL STREET JOURNAL, June 27, 1987, p.27 for further details.) Based on my experience as a chief information executive, I would estimate the incremental one time cost for for implementing this new tax policy in a major corporation to be well in excess of $0.5 million. Annual costs, including substantial additional computer time, would be at least $100,000 per year since elaborate changes would have to be made to General Ledger, Inventory Records, Purchasing Records, etc. In the same way as certain actions by private firms are subject to an "Environmental Impact Statement", Federal Legislative and Administrative actions should be subject to a "Productivity Impact Statement."

[26] Committee on Science, Space and Technology, *Agenda for Study of U.S. Technology Policy*, Unpublished private draft, May 27, 1987

[27] The matter of preserving the confidentiality of detailed business information is amenable to proven solutions.

Mr. MACKAY. Thank you.
Dr. Mowery.

STATEMENT OF DAVID MOWERY, STUDY DIRECTOR, PANEL ON TECHNOLOGY AND EMPLOYMENT, NATIONAL ACADEMY OF SCIENCES

Dr. MOWERY. Thank you.

For the last year I have had the privilege of serving as the study director of the Panel on Technology and Employment of the National Academy of Sciences.

Mr. MACKAY. I'm sorry. That's very distracting to us. If the gentleman who is talking to Mr. Strassmann will wait until the conclusion of the hearing. Excuse me. Go ahead.

Dr. MOWERY. That's all right. Thank you.

The Panel on Technology and Employment sponsored by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine, with funding from a variety of sources.

The panel's membership was drawn from business, labor, academic experts on workforce adjustments and labor economics, and former Federal and state officials. The report of our panel was released about two weeks ago today, I guess, on the 17th of June. I am appreciative of the invitation to come and talk to the Technology Policy Task Force about the portions of our report that deal with the impact of technology on employment, and the recommendations of the reports for workforce adjustment policy.

Despite the very diverse membership and very broad charge to the panel from the Committee on Science, Engineering and Public Policy of the Academy complex, the panel rapidly and at an early point in its deliberations reached the consensus on the role of technology in the U.S. economy and on the role of technology on affecting employment and earnings. This consensus stated that rather than being a central cause of problems on high unemployment and low earnings growth within the U.S. economy, technology and technological change are key parts of the solution to these problems.

In a U.S. economy facing increasingly intense foreign competition, the maintenance of high levels of employment and earnings require productivity growth, as Dr. Lawrence emphasized, which in turn rests in part on the rapid development and rapid adoption of new technologies. The panel's concerns throughout its reports I think reflect a concern with more rapid adoption and encouragement of new technologies within the U.S. economy.

The central policy issue, therefore, for the panel was managing the development and adoption of these new technologies in the most humane and rational way possible, trying to employ a portion of the affluence created by the employment of new technologies to assist individuals who experience adverse economic impacts as a result of the adoption and widespread use of these new technologies.

Such policies are important for equity reasons, but also because they can support the attainment of a higher level of technological sophistication and international competitiveness within this econo-

my as a result of the fact that these policies can reduce potential public resistance to the more rapid adoption of new technologies, and also have the effect of improving the quality and the training of the workforce.

I would like then to quickly summarize a couple of conclusions of the panel with respect to technology and its employment effects within the economy, and then move on to summarize the findings and the policy recommendations. A couple of these conclusions I think deserve particular attention.

The panel concluded that the employment impacts of technological change, when compared with other sources of employment and economic change within this economy, or indeed other economies, occur relatively gradually. I think Mr. Strassmann's observation on the slow pace at which a productivity payoff from office automation is being realized is consistent with this conclusion of our panel.

The fact is that the realization of the employment impacts of new technologies requires an extended period of investment in these technologies, and learning about the employment and the debugging of these technologies. So the diffusion, as economists say, and the realization of these employment impacts, when you compare it to something like OPEC oil price increases, exchange rate fluctuations, or a range of other external economic shocks, are realized relatively gradually.

The other point I would make or that the panel made about the characteristics of technological change is that the impacts of new technologies on the conditions of work, and indeed even on the skilled requirements of employment, are not determined solely by the technical characteristics or the engineering characteristics of these technologies, but are influenced powerfully by the particular policies adopted by managers and workers in deployment of these technologies within the work place.

That is to say, in its impacts on skills, in its impacts on productivity, on product quality, and even on profitability, technology is but one piece of a complex of factors, including the management of the adoption of technology, including the organization of the firm, including the reorganization of work practices that effect its impact on skills, on product quality, and on productivity,

Therefore, in many cases the adoption of new technologies requires a number of changes in these non-technological dimensions of management.

Let me move on then to summarize quickly some of the key findings with respect to employment of the panel. The panel concluded that technological change—and this is, I think, quite consistent with Dr. Ginzberg's statement—is one of a large number of forces that affect total employment and unemployment within the U.S. economy. Indeed, technological change, when compared with the state of aggregate demand, the rate of overall economic growth, is probably one of the less significant factors.

That is not to deny, however, the fact and the likelihood that technological change does, has had, and will continue to have severe consequences on the employment prospects for individuals in specific occupations and specific industries. But the impacts, by and large, are sectoral rather than aggregate. Therefore, the role,

in the panel's view, of adjustment policies adopted by the public and private sectors, is to facilitate the movement of workers and resources from declining to expanding sectors.

There is also little evidence uncovered by the panel that technological change will dramatically increase the skill requirements necessary to obtain quality jobs in the work place of the future. This reflects the tendency of technologies over the course of their development and evolution to reduce their skill requirements for operation. If you compare mainframe computers of the early 1950's with the desktop personal computers of the mid-1980's, I think you'll find that the skill requirements for operation have declined rather dramatically.

So we don't see a need for a radical upgrading, for example, in computer literacy of the U.S. population as a whole in order to obtain quality entry level jobs. What the panel does find is that basic skills of literacy, numerical reasoning, problem solving, written communication, are and will continue and probably will become more important for labor force entrants to obtain quality jobs in the work place of the future. And the lack of basic skills within a significant portion of the experienced displaced worker population constitutes a serious problem for adjustment policy.

Estimates range as high as 20 to 30 percent of experienced displaced workers having serious deficiencies in basic skills. This is something that obviously impedes their adjustment to a very significant degree.

Two other key findings: The employment prospects for women and minority workers, the panel concluded, should not be severely differentially affected by technological change. The primary channels of impact have to do with occupational segregation, and with the impact of technological change in making more important basic skills within the work place. We do not find a substantial impact of technology through these channels on female and minority employment prospects.

The panel concluded that the way to address these potential impacts is through improving basic skills preparation of minority labor force entrants, and continuing to enforce and push for vigorous enforcement of affirmative action policies within the work place, since this has the effect of broadening the occupational options open to workers from all of these groups.

The panel also considered the evidence on the impacts of technological change on income distribution and on the creation of a two-tiered workforce within the U.S. economy, and did not find compelling evidence to suggest that the recent technological change has had any relationship to changes in the household income distribution within this economy. Nor did the panel find that technological change thus far has had a significant impact on polarizing the structure of the workforce, that is to say, creating a two-tiered workforce.

Let me briefly summarize the policy recommendations of the panel which deal with workforce adjustment.

Two groups of workers received the bulk of attention of the Panel on Technology and Employment with respect to policies for workforce adjustment. The first group is labor force entrants whose employment prospects may be affected adversely by technological

change. The second group is experienced members of the workforce who may be displaced by technological change.

With respect to labor force entrants, the panel's recommendations largely concurred with the concerns of a number of other reports about the quality of basic skills preparation for labor force entrants within this economy, particularly with respect to minority labor force entrants.

Concerning displaced experienced workers, the panel recommended options for modifications in Title III of the Federal Job Training Partnership Act to improve JTPA's coverage of the displaced worker population—current estimates suggest that no more than six to seven percent are actively enrolled in or are served by Title III programs—to strengthen the ability of the JTPA program particularly to serve the basic skills training requirements of the sizeable proportion of the displaced worker population who are in need of these; also to improve the ability of this program to deliver job-related retraining; a provision for additional income support for workers enrolled in training; and the provision of loan guarantees or direct loans to displaced workers for retraining, relocation, or reestablishment of independent businesses.

Many of these recommendations or options for modification of JTPA made by the panel are allowed under the current JTPA statutes and require only administrative action. In its recommendations the panel also advocated or advised against restricting eligibility for such adjustment assistance to only those workers who could demonstrate they had been displaced by technological change.

The panel felt that targeting workers according to the cause of their displacement would induce severe administrative problems and result in severe delays in the delivery of services, simply because its so difficult to determine the precise cause of displacement of an experienced worker. Consider the relative roles of technological change in the U.S. economy and technological change in foreign economies in displacing workers in trade-impacted industries, for example. Should technological change in Japan be counted as a source of displacement for workers in the U.S. auto industry who are displaced by imports? Is it imports or is it technological change? Should we spend 14 months trying to decide which of these it is? If we do, the panel felt, we'll end up not getting the services to the workers when they need it.

The panel also recommended that adjustment assistance for workers be combined with Federal action to ensure advanced notice of plant shutdowns or mass layoffs of workers. The argument for this recommendation was that adjustment assistance depends critically for its effectiveness on early response, and ideally, response in advance of displacement. Therefore, advance notice can improve the effectiveness of existing public investments in worker adjustment assistance programs. Advance notice can also, in the opinion of the panel, reduce the costs to the public sector of the unemployment that results from plant shutdowns and mass layoffs. And advance notice can benefit individual workers by reducing the duration of their unemployment.

The panel argued as well that advance notice is in many ways a policy that enhances the efficiency with which market mechanisms

operate. It is a policy that improves the distribution of information and the flow of information to workers, and evens the distribution of information between workers and employers. It is also a policy that has the effect of avoiding the shifting of a significant portion of the costs of plant shutdowns and large layoffs from employers to the public sector. In some sense, advance notice operates to reduce the severity of an externality, as economists say, within the labor market.

Finally, the panel made a number of recommendations to private sector managers and workers to encourage cooperation between labor and management in the adoption of new technologies, and in the improvement of managerial education in the evaluation and management of the adoption of new technologies.

These include consultation between management and workers in advance of the introduction of new technologies; consideration by managers of employment security guarantees, and by workers of revisions in job classification schemes and compensation schemes; and the improvement of education for both currently employed and entrant managers in the evaluation and the management technology.

Thank you.

[The prepared statement of Dr. Mowery follows:]

TECHNOLOGY AND LABOR FORCE ADJUSTMENT

Testimony before the Technology Policy Task Force,
Committee on Science, Space and Technology
U.S. House of Representatives
July 1, 1987

David C. Mowery
Director, Panel on Technology and Employment
National Academy of Sciences, National Academy of Engineering,
and Institute of Medicine

I. Introduction

The Panel on Technology and Employment was organized in 1985 by the Committee on Science, Engineering and Public Policy (COSEPUP), a joing committee of the National Academies and the Institute of Medicine. COSEPUP asked the Panel to undertake a comprehensive review of the effects of technology on the future level and distribution of employment and earnings within the U.S. economy, the skill requirements for future employment, the employment prospects for women, minorities, and labor force entrants, and the effectiveness of existing public and private policies for worker adjusment. Members of the Panel, which was chaired by Dr. Richard M. Cyert, President of Carnegie-Mellon University, included leaders from business, labor, and public education, academic experts on labor economics and adjustment policies, and former state and federal government officials. The Panel's report, Technology and Employment: Innovation and Growth in the U.S. Economy, was released on June 17 of this year, and represents a consensus analysis and set of recommendations on the challenges of technological change for economic growth and employment. My written statement and oral testimony summarize those portions of the report that concern worker adjustment issues and policies. A copy of the COSEPUP charge to the Panel and a copy of the Executive Summary of the report are included with my written statement.

II. The Central Conclusion of the Study

Despite its diverse membership and wide-ranging concerns, the Panel reached a consensus at an early point in its deliberations regarding the relationship of technology to employment within the U.S. economy of the future. Simply put, this consensus stated that rather than being a central cause of the problems of unemployment and low earnings growth within this

economy, technology is a key part of the solution to these problems. The U.S. economy faces increasingly intense foreign competition in a number of industries, and the maintenance of high levels of employment and earnings in the face of such competition requires productivity growth, which in turn depends on the rapid development and adoption of new technologies.

The central issue for policy is managing the development and adoption of new technologies within this economy in the most humane and rational fashion possible, employing a portion of the affluence created by technology to assist those individuals who experience adverse economic effects from the adoption and use of new technologies. The development of such policies is important for equity reasons, but also can contribute to more rapid adoption of technology, due to the reduction of potential public resistance to new technologies and improvement in the adjustment capabilities of the work force that can result from such policies.

This central conclusion, as well as the Panel's detailed policy recommendations, rested on a set of observations and conclusions concerning the nature of technological change and the growth of the U.S. economy during the post-1945 period. These observations and conclusions are summarized briefly in the next section.

III. Characteristics of Technological Change and Employment Growth in the U.S. Economy

A. The employment impacts of technological change typically occur gradually, by comparison with other sources of economic change. Although scientific discovery may and often does occur rapidly or discontinuously, realization of the employment effects of technological change requires the widespread adoption of new technologies, which depends on the relatively gradual processes of investment in and "debugging" of new technologies.

B. Indicators of the aggregate rate of technological change have a number of flaws, but do not suggest a sudden increase in the overall rate of technological change. Although advances in some areas of technology have been rapid, such measures of technological change as the rate of growth in labor productivity for the overall economy (which incorporates the effects of both the development and the adoption of new technologies) or the rate of growth in new patents granted by the U.S. Patent Office, do not exhibit sudden increases in growth in recent years. Indeed, in the case of aggregate productivity growth, the record since 1973 has been disappointing.

C. The impacts of new technologies on the conditions of work, the quality of products, and even the rate of growth of labor productivity are not determined solely by the technical characteristics of these innovations. Managers and workers frequently have great discretion in the implementation of a new technology, which complicates the prediction of the effects of new technologies on the skill requirements of future jobs. In addition, this absence of technological determinism means that the adoption of new technologies often must be accompanied by substantial changes in management practices, work force organization, the organization of production processes, and even the design of products, to realize the full payoffs of these technologies.

D. The U.S. appears to be lagging behind, rather than leading, other industrial nations in the adoption of a number of important manufacturing process technologies, including robots and computer-numerically controlled machine tools. A substantial portion of the penetration of U.S. domestic markets by imported goods during the past decade may reflect the more rapid generation and adoption of new technolgies by foreign firms.

E. Foreign trade has increased substantially in importance within the U.S. economy during the past two decades, and U.S. manufactured exports depend to a greater extent on R&D-intensive products than do the manufactured exports of other OECD nations. At the same time, the rate at which new technologies and scientific knowledge flows across national boundaries appears to have increased, meaning that any knowledge-based competitive advantage held by U.S. firms may well be more fleeting in the future. At the same time, U.S. firms are in a position to benefit from technological advances in other nations, through aggressive monitoring of foreign developments.

F. Labor force growth is projected to be much lower during the next decade than has been true of the previous 15 years. This deceleration (labor force growth during 1984-95 was projected by the U.S. Bureau of Labor Statistics[1] to be roughly one-half as great as the rates observed during 1970-84) should improve the employment prospects for labor force entrants, and may reduce somewhat upward pressure on aggregate unemployment rates.

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[1]U.S. Bureau of Labor Statistics, 1986. Employment Projections for 1995: Data and Methods. Washington, D.C.: U.S. Government Printing Office.

III. Panel Findings and Recommendations

Building on the above observations, as well as an extensive body of other evidence and analysis, the Panel reached a number of findings and made recommendations in several areas, including the employment- and skill-related impacts of technological change. The policy recommendations in particular were framed with a view to supporting more rapid development and adoption of new technologies while easing the burden of adjustment for workers and managers.

A. Findings

Technological change is but one of a large number of forces afffecting total employment and unemployment, and appears to be far from the most important factor. The rate of economic growth, the state of aggregate demand, and the impact of "shocks" to the U.S. economy (e.g., the 1973 oil price increases) appear to be more significant determinants of total employment than technological change. The higher unemployment rates and displacement of experienced workers during the 1980s do not appear to be linked to more rapid technological change during this period--indeed, these phenomena have coincided with low rates of labor productivity growth for the economy.

Evidence from the U.S. General Accounting Office's survey of plant closings and mass layoffs,[2] as well as other studies of manufacturing employment displacement during the 1980s, suggest that import penetration has accounted for much greater employment losses in manufacturing than has technological change. Indeed, the absence of technological change in many U.S. industries, relative to foreign competitors, may be responsible for much of the displacement observed during the past decade. Nevertheless, technological change will cause employment displacement in specific industries and occupations, even as it aids in the creation of new jobs elsewhere. Public and private adjustment policies should facilitate the movement of workers and resources from declining to expanding sectors.

Little evidence suggests that technological change will dramatically increase the skills necessary to obtain quality employment in the economy of the future. In part, this conclusion reflects the tendency of technologies to develop in ways that support their use by workers with lower levels of

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[2]U.S. General Accounting Office, 1986. Dislocated Workers: Extent of Business Closures, Layoffs and the Public and Private Response. Washington, D.C.: U. S. Government Printing Office.

job-related skills. Basic skills (numerical reasoning, problem solving capabilities, written communication, and literacy), however, are likely to become even more important in the workplace of the future. The 20-30% of the displaced worker population with deficient preparation in basic skills, as well as labor force entrants lacking strong basic skills, will face difficulties in adjusting to technological and economic change.

The employment prospects for women and minority workers should be largely unaffected by technological change--any projected adverse consequences of such change are very small, and are dwarfed by projections of overall growth in employment opportunities. Nonetheless, affirmative action and other policies to combat racial and sexual discrimination in the workplace are among the most effective methods to reduce any disproportionate adjustment burden borne by these groups. Such policies broaden the range of occupational options available to workers, and thereby ease their transition from declining to expanding areas. In addition, policies to strengthen the quality of basic skills preparation for labor force entrants from minority groups are important in improving the ability of these individuals to obtain good jobs in the future workplace.

The Panel also considered the evidence concerning the impact of technological change on the level of average earnings and the distribution of income within this economy. Earnings growth during the post-1945 period has been dependent on growth in labor productivity--declines in labor productivity growth following 1973 are mirrored in declines in average earnings during this period. Technological change, by virtue of its ability to support higher productivity growth, thus can make a significant contribution to higher average earnings. With respect to the distribution of household incomes (income from both employment-related and other sources received by all members of a single household), the evidence suggests that recent increases in the inequality of this distribution reflect changes in the structure of households (the rise of female-headed households, on the one hand, and two-earner households, on the other hand), as well as changes in federal budgetary and tax policies during the early 1980s.

B. Recommendations for worker adjustment

Two groups of workers are likely to be affected adversely by technological change--labor force entrants who are unable to find jobs, and experienced workers who lose their jobs due to technological change. The Panel's recommendations for assistance for labor force entrants focused on the need to improve the basic skills preparation of this group, consistent

with the concerns of numerous other recent studies of primary and secondary education.[3]

With respect to experienced workers who are displaced by technological change, the panel recommended options for modifications in Title III of the Federal Job Training Partnership Act to improve this program's coverage of the displaced worker population (the program currently serves only 6-7% of the displaced worker population), to strengthen the ability of the program to provide training to workers in basic and job-related skills, to improve income support for workers engaged in training, and to provide loan guarantees or direct loans to displaced workers for retraining, relocation, or the establishment of independent businesses. Many of these modifications are allowed under the current JTPA program, and would require only administrative action. The Panel also advocated revisions of state unemployment insurance laws to ensure that any recipient of unemployment insurance enrolled in a training program can continue to receive unemployment compensation.

The Panel recommended against any attempt to restrict eligibility for worker adjustment assistance programs to only those workers able to demonstrate that their displacement was due to technological change. Not only would such a requirement require the establishment of a separate program, outside of Title III of JTPA (which does not restrict eligibility according to the cause of displacement), but the administrative difficulties and service delivery delays that would result from such a requirement would reduce the effectiveness of worker adjustment assistance.

Since the Panel's policy options were intended to be available for all displaced workers, regardless of the cause of individuals' displacement, estimates of the costs of these options depend on estimates of the size of the population of displaced workers and their rates of participation in adjustment assistance programs. The U.S. Bureau of Labor Statistics found that when the definition of a displaced worker is restricted to workers with at least three years' experience in the job from which they were laid off, the annual flow of displaced workers during 1979-83 was roughly 1 million persons, an estimate that increased to 2.3 million persons annually when the 3 years' job

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[3]See, for example, the report of the COSEPUP Panel on Secondary School Education for the Changing Workplace, High Schools and the Changing Workplace: The Employers' View (Washington, D.C.: National Academy Press, 1984).

experience restriction was relaxed.[4] For an annual flow of 1 million displaced workers, the estimated costs of the Panel's recommendations would range from $130 million to $785 million, as participation rates increased from 5% of this population to 30%, an aggregate participation rate considerably higher than overall rates of participation in existing or previous adjustment assistance programs. If the annual flow is assumed to be to 2.3 million, these costs range from $300 million to $1.8 billion.

The design of improved worker adjustment assistance programs, however, is hampered by a lack of knowledge. There have been very few rigorous evaluations (i.e., evaluations that employ control groups and attempt to minimize sample selection bias) of worker adjustment assistance programs in recent years. Although these evaluations concluded that adjustment assistance does improve the employment prospects of displaced workers, they do not provide reliable guidelines for program design--we cannot determine, for example, the relative importance of job search assistance, as opposed to retraining, in improving the re-employment prospects of participants. New initiatives in worker adjustment assistance programs must incorporate substantial provisions for experiments and rigorous evaluations.

The Panel also recommended that federal action be taken to ensure that as many workers as possible receive substantial advance notification (at least 2-3 months) of plant shutdowns or large-scale layoffs. Worker adjustment assistance programs are more effective when services are provided to workers prior to their displacement. Such pre-layoff assistance generally is feasible only in the context of advance notice. In addition to improving the effectiveness of public investments in worker adjustment assistance programs, advance notice reduces the duration of unemployment following layoff, thus reducing public expenditures on unemployment compensation. A number of groups, including the National Association of Manufacturers, the Business Roundtable, the Secretary of Labor's Task Force on Economic Adjustment and Worker Dislocation, and the President's Commission on Industrial Competitiveness, have endorsed voluntary advance notice.

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[4]For a more detailed description of the data from the 1984 special supplement to the Current Population Survey on which these estimates are based, see P. O. Flaim and E. Sehgal, "Displaced Workers of 1979-83: How Well Have They Fared?", Monthly Labor Review, 1985.

Although there is disagreement over the mechanisms that will provide the broadest possible coverage of the U.S. work force, voluntary advance notice does not appear to provide substantial advance to more than a small share of the work force. According to the U.S. General Accounting Office,[5] nearly 30% of the workers surveyed received no advance notice of layoffs or plant shutdowns, while blue-collar workers in nonunion establishments received an average of only two days' notification.

Under the current voluntary system of advance notice, the costs of plant closings in which advance notice is not provided are borne primarily by the taxpayers (including other employers) and the affected workers--employers choosing to close without advance notice create an exernality, reflecting the fact that the costs of such actions are not fully taken into account by employers. Requiring advance notice can redistribute the costs of layoffs and plant shutdowns. Federal action to broaden the coverage of workers by advance notice also follows in an established tradition of actions to improve the functioning of market mechanisms (e.g., securities market regulation, consumer protection statutes and regulations) by ensuring that information available to one party to a transaction is not employed strategically or otherwise manipulated (as in the case of "insider trading" on Wall Street).

Reflecting these considerations, the Panel recommended that federal action be taken to broaden the coverage of the U.S. work force by advance notice, with appropriate provisions to exempt small firms and those firms encountering unforeseen business circumstances. The Panel recommended either a federal requirement for advance notice or a tax-based incentive plan, which would combine tax credits on the corporate income tax with surcharges on federal unemployment insurance taxes to reduce the tax burden on firms providing advance notice.

The Panel also made a number of recommendations to private sector managers and workers to encourage cooperation between labor and management in the adoption of new technologies and improvements in managerial education in the evaluation and adoption of new technologies. These recommendations include consultation between management and the labor force prior to the introduction of new technologies (a practice that often results in improvements in the design of production processes and occasionally products), the respective consideration by management and workers of employment security guarantees and

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[5]U.S. General Accounting Office, 1987. Plant Closings: Information on Advance Notice and Assistance to Dislocated Workers. Washington, D.C.: U.S. Government Printing Office.

revisions in job classification and compensation systems, and greater use of severance payments for senior workers facing layoffs. In addition, the education of managers must be improved to strengthen their ability to evaluate new technologies effectively and to implement these technologies successfullly in the workplace, consistent with the Panel's observation that the management of this process often makes the difference between success and failure in technology adoption.

IV. Conclusion

Technological and structural change pervade the U.S. economy, as they do any dynamic economy. To ensure growth in earnings and employment opportunities for U.S. workers, technology should be viewed not as the problem but rather as a key component of the solution. The employment losses that will result from a decline in U.S. international competitiveness due to lagging development and adoption of new technologies are likely to outweigh any that might result from rapid technological change. With the development of policies that support investment in the human resources of this nation, as well as policies that deal with the consequences of technological change in an equitable and humane fashion, this latest in a series of transitions to new structures of work and employment can be accomplished efficiently and fairly. In the modern world economy, there is little choice--the United States must remain at the leading edge of technology in order to preserve and improve the economic welfare of all Americans.

ATTACHMENTS

I. Executive Summary of Technology and Employment: Innovation and Growth in the U.S. Economy.

II. Study Charge.

Executive Summary

TECHNOLOGY AND EMPLOYMENT

Innovation and Growth in the U.S. Economy

Richard M. Cyert and David C. Mowery, Editors

Panel on Technology and Employment
Committee on Science, Engineering, and Public Policy

National Academy of Sciences
National Academy of Engineering
Institute of Medicine

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The Committee on Science, Engineering, and Public Policy is a joint committee of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. It includes members of the councils of all three bodies.

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Preface

In recent years, concern over the effects of technological change has led many Americans to ask whether the development and application of new technologies within the U.S. economy will create new employment or contribute to higher unemployment. Many Americans appear to be pessimistic about the answer to this question, an attitude that, if anything, has become more widespread, despite the nation's recovery from the 1981–1982 recession. The relationship of technology to employment and the effects of technological change on the workplace and on U.S. productivity have become topics of national debate in the face of slow economic growth, high unemployment, and stagnation or decline in the real (inflation-adjusted) earnings of workers since 1970. The importance of these issues to the economic welfare of all Americans, coupled with the impetus of a 1983 National Academy of Engineering symposium that revealed a range of conflicting opinions on the long-term implications of technological change for employment and a request from the Council of the National Academy of Engineering, prompted the Committee on Science, Engineering, and Public Policy (COSEPUP)[1] to initiate the current study following consultation with scholars, government officials, and business, labor, and civic leaders familiar with the employment-related effects of technology. Thus, in 1985 COSEPUP created the Panel

[1]COSEPUP is a joint committee of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine

on Technology and Employment to carry out a new inquiry into the impact of technological change on employment opportunities, productivity, and the quality of work life (COSEPUP's charge to the panel is Appendix A).

The Panel on Technology and Employment first met in September 1985 and continued to meet at regular intervals during the next 18 months. This report incorporates the results of our discussions in panel meetings, the expertise of individual panel members, staff research and analysis, briefings from experts in industry, academia, and labor (Appendix B is a list of individuals who presented briefings to the panel or served as consultants), and the findings of the research papers commissioned by the panel (see Appendix C). A selection of these papers will be published separately in *Studies in Technological Change, Employment, and Policy* in late 1987. To disseminate our analysis and findings as widely as possible, we will also publish a summary of our report, entitled *Technology and Work in America: A Critical Challenge*.

This report addresses a number of issues that have surfaced in the debates over the employment impacts of technological change. These issues include the effects of technological change on levels of employment and unemployment within the economy; on the displacement of workers in specific industries or sectors of the economy; on skill requirements; on the welfare of women, minorities, and labor force entrants in a technologically transformed economy; and on the organization of the firm and the workplace. We have concluded that technological change will contribute significantly to growth in employment opportunities and wages, although workers in specific occupations and industries may have to move among jobs and careers. Included among our policy recommendations, therefore, are initiatives and options that can assist workers in preparing for and making such transitions.

In part because of the increased importance of international trade and competition within this economy, technological change has become essential to the preservation and expansion of U.S. employment and wages. The employment losses that result from a decline in U.S. international competitiveness are likely to outweigh any that might result from rapid technological change. Accordingly, we have developed policy recommendations to aid firms in the development and adoption of new technologies, so as to enhance their international competitiveness.

Technological and structural change pervade the U.S. economy, as they do any dynamic economic system. To ensure growth in economic opportunities for U.S. workers, technology should be viewed not as the problem but rather as a key component of the solution. With the development of policies that support investment in the human resources of this nation, as well as policies that deal with the consequences of

technological change in an equitable and humane fashion, we believe that this latest in a series of transitions to new structures of work and employment can be accomplished efficiently and fairly. In the modern world economy, there is little choice—the United States must remain at the leading edge of technology in order to preserve and improve the economic welfare of all Americans.

On behalf of the panel, I would like to thank the numerous individuals who met with us in the course of our deliberations to provide briefings and other assistance and information. We also wish to express our appreciation for the work of the panel's professional staff: Dr. David Mowery, the study director; Dennis Houlihan; Nina Halm; Sara Collins; Leah Mazade, who worked with the staff in editing the report for publication; and Dr. Leonard Rapping, the panel's study director from June 1985 through March 1986. In addition, the panel is indebted to Dr. Allan Hoffman, executive director of COSEPUP, for his unflagging support of this study since its inception and to the reviewers of our report, including the members of COSEPUP. Finally, I extend my personal thanks to the members of the panel, who served with dedication and good humor throughout this study of a difficult and extensive set of problems and issues.

Richard M. Cyert
Chairman

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Executive Summary

TECHNOLOGY AND AMERICAN ECONOMIC WELFARE

Technological change transforms the production of goods and services and improves the efficiency of production processes. It also allows the production of entirely new goods and services. Since the beginnings of American industrialization, such change has been a central component of U.S. economic growth, growth that has been characterized by the creation of new industries and the transformation of older ones as a result of innovations in products and processes. Technological advance has also played an increasingly important role in the growth of income per person during the past 100 years; its contribution to that area and to economic growth is likely to increase still further as the United States becomes more closely linked to the global economy.

The use of new technologies in production processes frequently reduces the labor and other resources needed to produce a unit of output; these reductions in turn lower the costs of production and the employment requirements for a fixed output level. If reductions in the demand for labor were the only effect of technological change on employment, policymakers addressing the problem of maintaining U.S. economic welfare would only have to balance the contributions of technological change against the costs of higher unemployment.

However, technological change has other important effects that historically have enabled society to achieve greater prosperity without sacrificing employment. By reducing the costs of production and thereby

lowering the price of a particular good in a competitive market, technological change frequently leads to increases in output demand; greater output demand results in increased production, which requires more labor, offsetting the employment impacts of reductions in labor requirements per unit of output stemming from technological change. Even if the demand for a good whose production process has been transformed does not increase significantly when its price is lowered, benefits still accrue because consumers can use the savings from these price reductions to purchase other goods and services. In the aggregate, therefore, employment often expands. Moreover, when technological change results in the development and production of entirely new products, employment grows in the industries producing these new goods. Historically and, we believe, for the foreseeable future, reductions in labor requirements per unit of output resulting from new process technologies have been and will continue to be outweighed by the beneficial employment effects of the expansion in total output that generally occurs. Indeed, the new realities of the U.S. economy of the 1980s and 1990s will make rapid development and adoption of new technologies imperative to achieving growth in U.S. employment and wages.

One crucial new reality of the U.S. economy of the 1980s is that it is more "open" to international trade than was the American economy of the 1950s and 1960s. The increased importance of trade means that higher productivity growth, which is supported by technological change, is essential to the maintenance of higher real earnings and the preservation of U.S. jobs. Moreover, the more rapid rates of international technology transfer characteristic of the modern economic environment mean that the knowledge forming the basis for commercial innovations need not be domestic in origin, just as U.S. basic research has underpinned the technological advances of firms in other nations.

The relative rates of development and adoption by U.S. and foreign industries of new process technologies affect the rates of growth in labor productivity (output per worker) in those industries and therefore can produce differences in labor costs among U.S. and foreign firms. To the extent that foreign firms develop and adopt new technologies faster than U.S. firms, the production costs of foreign producers will fall more rapidly. Barring shifts in U.S. and foreign currency exchange rates, declines in the wages of U.S. workers, or comparable technological advances by U.S. firms, these reductions in foreign producers' costs will decrease markets for U.S. firms and ultimately reduce jobs for American workers within the affected industries. To remain competitive in the absence of technological change and labor productivity growth in these industries, U.S. labor costs, relative to those of foreign producers, must be lowered, either by direct reductions in wages or through government policies that support devaluation of the dollar. Either of these methods

decreases U.S. workers' incomes relative to those of foreign workers. Thus, if U.S. firms fall behind foreign firms in developing and adopting new technologies, the alternatives are not attractive—U.S. workers must accept fewer jobs or lower earnings.

Yet, if U.S. firms consistently develop and adopt new technologies more rapidly than foreign producers, the picture is quite different. The resultant higher productivity growth in U.S. industries will support reductions in production costs, which will enable U.S. workers to retain higher-wage jobs. Because new knowledge and technologies developed in the United States now are transferred to foreign competitors more rapidly than they were in the past, however, any technology-based advantages held by U.S. firms and workers over foreign firms and workers are likely to be more fleeting in the future. A key factor in sustaining American living standards and employment thus is continued public and private investment in the generation of new knowledge. Of equal importance, however, is the need for U.S. firms to advance from fundamental knowledge to commercial innovations more rapidly than in the past.

We have defined our task in this study as that of analyzing the contribution of technological change to employment and unemployment. Because technological change plays a limited role in determining total employment, its impacts in this area are primarily sectoral in nature, and those impacts are affected only indirectly by aggregate economic conditions. We therefore regard the design of macroeconomic policies aimed at achieving high levels of aggregate demand and employment as outside this panel's charge. Despite the increased importance of international trade for this economy and the role of technological change within it, a discussion of trade policies also would have taken this panel far beyond its charge; trade policy therefore was not considered in detail by the panel.

Our principal finding may be succinctly stated:

Technological change is an essential component of a dynamic, expanding economy. Recent and prospective levels of technological change will not produce significant increases in total unemployment, although individuals will face painful and costly adjustments. The modern U.S. economy, in which international trade plays an increasingly important role, must generate and adopt advanced technologies rapidly in both the manufacturing and nonmanufacturing sectors if growth in U.S. employment and wages is to be maintained. Rather than producing mass unemployment, technological change will make its maximum contribution to higher living standards, wages, and employment levels if appropriate public and private policies are adopted to support the adjustment to new technologies.

Technological change often involves difficult adjustments for firms and

individuals. Workers must develop new skills and may be required to seek employment in different industries or locations. In many cases, workers suffer severe financial losses as a result of permanent layoffs or plant closings. Managers also face serious challenges in evaluating and adopting new manufacturing and office technologies in an increasingly competitive global economy.

Given these realities, we recommend policies to help workers adjust to technological change. Our recommendations propose initiatives to aid displaced workers through job search assistance, basic skills training, training in new job-related skills, and advance notice of plant shutdowns and large-scale permanent layoffs. Through these initiatives we focus on the need to assist individuals who experience hardship as a result of technological change and to aid them in securing new employment. We also offer recommendations that call on U.S. firms to develop and adopt new technologies more rapidly and suggest policies—both public and private—that might encourage them to do so.

The technological revitalization of American industry that is the goal of these recommendations is essential to the national welfare. The alternative to rapid rates of technological change is stagnation in U.S. wages and employment. In the end, no trade-off need be made between the goals of high levels of employment and rapid technological change. Policies that help workers and managers adjust to technological change can aid and encourage the adoption of productivity-enhancing technologies.

Technological change poses significant challenges to government policymakers, business, and labor, as well as to individual workers. Although the United States remains a technological and economic leader, the performance of this economy in adopting new technologies, achieving higher levels of productivity, and dealing with the adjustment of workers to new technologies leaves a great deal to be desired. If business, labor, and government fail to develop appropriate adjustment policies, the eventual price may be reduced technological dynamism and a decline in the international competitiveness of the U.S. economic system.

CENTRAL FINDINGS

In addition to the principal finding already stated, the central findings of this panel cover a number of dimensions of the employment impacts of technological change and form the basis for our policy recommendations, summarized below and discussed in greater detail in Chapter 10 of our full report. The complete set of findings for this study is compiled in Chapter 9.

Employment and Wage Impacts of Technological Change in an Open Economy

- *Historically, technological change and productivity growth have been associated with expanding rather than contracting total employment and rising earnings. The future will see little change in this pattern.* As in the past, however, there will be declines in specific industries and growth in others, and some individuals will be displaced. Technological change in the U.S. economy is not the sole or even the most important cause of these dislocations (see Chapters 2 and 3).
- *The adoption of new technologies generally is gradual rather than sudden.* The employment impacts of new technologies are realized through the diffusion and adoption of technology, which typically take a considerable amount of time. The employment impacts of new technologies therefore are likely to be felt more gradually than the employment impacts of other factors, such as changes in exchange rates. The gradual pace of technological change should simplify somewhat the development and implementation of adjustment policies to help affected workers (see Chapter 2).
- *Within today's international economic environment, slow adoption by U.S. firms (relative to other industrial nations) of productivity-increasing technologies is likely to cause more job displacement than the rapid adoption of such technologies.* Much of the job displacement of the past 7 years does not reflect a sudden increase in the adoption of laborsaving innovations but instead is due in part to increased U.S. imports and sluggish exports, which in turn reflect macroeconomic forces (the large U.S. budget deficit and the high foreign exchange value of the dollar during 1980–1985), slow adoption of some technologies in U.S. manufacturing, and other factors (see Chapters 2 and 3).
- *The rate of technology transfer across national boundaries has grown; for the United States, this transfer increasingly incorporates significant inflows of technology from foreign sources, as well as outflows of U.S. research findings and innovations.* In many technologies, the United States no longer commands a significant lead over industrial competitor nations. Moreover, technology "gaps" (the time it takes another country to become competitive with U.S. industry or for U.S. firms to absorb foreign technologies) are likely to be shorter in the future (see Chapter 3).

Technology and the Characteristics of Tomorrow's Jobs

- *New technologies by themselves are not likely to change the level of job-related skills required for the labor force as a whole.* We do not project a uniform upgrading or downgrading of job skill requirements in the

U.S. economy as a result of technological change. This does not deny the need, however, for continued investment and improvement in the job-related skills of the U.S. work force to support the rapid adoption of new technologies that will contribute to U.S. competitiveness (see Chapter 4).

- *Technological change will not limit employment opportunities for individuals entering the labor force with strong basic skills.* The most reliable projections of future job growth suggest that the number of jobs in the broad occupational categories accounting for the majority of entrant employment will continue to expand. Combined with a projected lower rate of growth in the entrant pool, this conclusion suggests that labor force entrants with strong basic skills (numerical reasoning, problem solving, literacy, and written communication) will fare well in the job markets of the future (see Chapter 5).

Technology and Work Force Adjustment

- *A substantial portion—from 20 to 30 percent—of displaced workers lack basic skills.* These workers often remain unemployed longer and have difficulty finding new jobs without incurring significant wage reductions. In view of the fact that technological and structural change in this economy will place increasing demands on the ability of workers to adjust, experienced workers who lack basic skills will face even greater difficulties in future job markets (see Chapter 3).
- *The evidence suggests that displaced workers who receive substantial advance notice of permanent job loss experience shorter periods of unemployment than workers who do not receive such notice.* Substantial advance notice (several months) of permanent layoffs or plant shutdowns appears to reduce the severity of worker displacement. Moreover, such a policy can improve the effectiveness of job search assistance, counseling, and retraining programs, thereby reducing the public costs of unemployment (see Chapter 7).
- *The primary federal program for displaced workers, Title III of the Job Training Partnership Act (JTPA), emphasizes the rapid placement of workers in new jobs. It does not appear to serve the needs of many displaced workers.* JTPA provides little training for the substantial number of displaced workers who need better basic skills; it also provides little extended training in job-related skills for other workers (see Chapter 7).
- *Displaced worker adjustment assistance programs reduce the duration of unemployment after displacement and result in higher wages in new jobs obtained immediately after participation in such programs.* There is limited evidence on the specific contribution of retraining in basic and job-related skills (a component of many such programs) to the employment and earnings prospects of displaced workers. Nevertheless,

it would be wrong to conclude from this that retraining is ineffective or that it has a negative impact on earnings or reemployment prospects. Too little is known about the components of effective adjustment programs for displaced worker populations with different characteristics because of the paucity of rigorous evaluations of such programs. Additional policy experiments and evaluations are badly needed to improve these programs (see Chapters 7 and 8).

POLICY OPTIONS AND RECOMMENDATIONS

Our policy options and recommendations are based on the conclusion that, with an appropriate policy structure, technological change can support growth in U.S. employment and living standards. Toward that end, we have developed options and recommendations for the public and private sectors that emphasize three broad initiatives in public and private sector policies: (1) public policies to aid worker adjustment to technological change; (2) public policies to support the development and application of advanced technologies; and (3) improvements in labor–management cooperation in the adoption of new technologies, as well as improvements in private managers' expertise in evaluating and implementing new technologies.

Although the overall U.S. standard of living and average real (inflation-adjusted) wages generally increase as a result of technological change, individuals suffer losses. Many of our public policy recommendations stem from the belief that a portion of the affluence created by technological change should be used to assist those suffering losses as a result of it. In addition, public policies that deal with the equitable distribution of gains and losses from technological change can facilitate such change by reducing the resistance of potential losers to new technologies in the workplace. Just as management policies to support adoption of new technologies within the firm must address worker concerns about adjustment and employment security (see Chapter 7 of our full report), public policies that aid adjustment can reduce potential resistance to new technologies and support their more rapid adoption. On balance, if policies are developed that will ease the burden of adjustment for those individuals faced with job loss and thereby facilitate the adoption of new technologies, all members of our society can benefit.

Recommendations for the Public Sector

Policies for Worker Adjustment

Our options and recommendations for assisting worker adjustment to technological change focus on the two groups that may be affected

adversely by such change: experienced workers who may lose their jobs as a result of the adoption of technology, and labor force entrants, whose employment prospects may be reduced by technological change. Our options and recommendations to assist experienced displaced workers focus primarily on modifications in the primary federal program for which technologically displaced workers, as well as workers displaced by other causes, are eligible, Title III of JTPA. We also suggest other policies (advance notification of plant shutdowns and large-scale layoffs) to enhance the effectiveness of Title III. Our recommendations to aid labor force entrants focus on the need for additional research and actions based on the reports of other expert groups, a decision that reflects the fact that a complete evaluation of policies affecting the educational attainment and basic skills preparation of entrants is beyond the scope of this report. Our public policy recommendations also address the impacts of technological change on the employment prospects for minority and female members of the labor force.

Options for Adjustment Assistance for Displaced Workers

We recommend that action be taken to improve existing JTPA Title III programs of job search and placement assistance and training in both basic and job-related skills for displaced workers. We recommend that some or all of the following options be implemented:

- *broadening the range of employment services provided to displaced workers and those facing imminent displacement, including job counseling, skills diagnosis, job search assistance, and placement services;*
- *increasing the share of Title III funds devoted to training in basic and job-related skills;*
- *broadening income support for displaced workers engaged in training;*
- *instituting a program of federally provided direct loans or loan guarantees, administered by state or local authorities, to workers displaced by technological change, plant shutdowns, or large-scale layoffs (these loans could be used by displaced workers to finance retraining or relocation or to establish new businesses); and*
- *establishing a program for demonstrations and experiments with rigorous evaluation requirements to test and compare specific program designs.*

In addition to these modifications to JTPA, we recommend revising state unemployment compensation laws to guarantee explicitly that displaced

workers who are eligible for unemployment compensation can continue to receive benefits while undertaking retraining.

We have concluded that the federal government should be the primary source of funding for the abovementioned policy options. Federal financing is preferable to state funding because of the inequities created by differences in the level of state resources for such programs. Indeed, states that are experiencing severe economic dislocations are likely to face serious problems in funding significant displaced worker programs. In view of the fact that one of the central motives for worker adjustment programs is the equitable distribution of the costs and benefits of new technology adoption among the U.S. population, the avoidance of regional inequities is an important consideration. One option for financing the economic adjustment loans, like the arrangements for other federal loan programs, would employ the Federal Financing Bank and therefore would not require federal funds from general revenues.

Estimates of the costs of these adjustment assistance options for displaced workers depend on estimates of the population of displaced workers. In Chapter 3, we note that estimates of the number of workers displaced annually range from 1 million, if displaced workers are defined as individuals with 3 years' employment in their jobs prior to layoff, to 2.3 million. Cost estimates also depend on assumptions about the rates of worker participation in such programs, an area in which reliable data are scarce. Existing programs that combine income support with retraining for displaced workers, such as the UAW-Ford program, have enrolled 10–15 percent of the eligible population (see Chapter 7). Although we lack conclusive evidence on this point, it may be that participation rates would be higher in programs involving displaced workers from industries that pay lower wages than the automotive industry.[1]

We have compiled estimates of the costs to the federal government of job search assistance, training, and extended unemployment compensation for two values of the annual flow of displaced workers (the two values are drawn from the 1984 survey of displaced workers conducted by the U.S. Bureau of Labor Statistics): 1 million workers, which is the estimated number of displaced workers who had been employed for 3 or more years in the job from which they were displaced; and 2.3 million, which is the estimated total number of workers suffering permanent job loss. As estimated rates of participation in these programs range from 5 to 30 percent of the displaced worker population, the estimated costs of these policy options range from $131 million (5 percent participation rate)

[1]Participation rates also will be affected by the policies and guidelines adopted by states in administering any system of training, job search assistance, and income support.

to $786 million (30 percent) for an annual flow of 1 million displaced workers. It is important to note that the highest estimated participation rate exceeds any observed thus far in a displaced worker training program in the United States. If we assume that the flow of eligible displaced workers is 2.3 million annually, the estimated costs of the program range from $301 million (5 percent participation rate) to about $1.8 billion (30 percent).[2] JTPA Title III outlays for fiscal year 1987 are roughly $200 million, although a significant expansion has been proposed in the President's budget for fiscal year 1988.

How could these policy options be financed? The panel discussed revenue alternatives and found no single method that was preferable to all others on equity and other grounds. In the absence of evidence suggesting that one alternative is superior to all others, the decision on funding sources and budgetary reallocations is properly political, involving considerations that extend well beyond this panel's charge.

Advance Notice of Plant Closures and Large Permanent Layoffs[3]

We have concluded that substantial (a minimum of 2–3 months) advance notice of permanent plant shutdowns and large permanent layoffs offers significant benefits to the workers who are displaced and to the nation by reducing the average duration of the workers' unemployment and lessening the public costs of such unemployment. The current system of voluntary advance notice, however, fails to provide sufficient advance notice to many U.S. workers. We therefore recommend that federal action be taken to ensure that substantial advance notice is provided to all workers. Although the panel agreed on the need for federal action to broaden the coverage of advance notice within the U.S. work force, panel members were not unanimous in their support of a specific legislative or administrative mechanism to achieve this goal. The panel believes that the following alternatives are viable options to achieve broader advance notice, with appropriate provisions to reduce the burden on small business and provide for unforeseen circumstances:

- *federal action to require employers to provide substantial advance notice of permanent plant shutdowns and large permanent layoffs; or*

[2]If the annual flow of displaced workers is estimated to amount to 1.2 million workers (the estimate used by the Secretary of Labor's Task Force on Economic Change and Dislocation, 1986), the estimated costs of these options range from $157 million to $943 million.

[3]Panel member Anne O. Krueger dissents from this recommendation. Her statement appears at the end of the Executive Summary and in Appendix D of the full report.

• *federal action to provide tax incentives for employers to give such notice.*

The current system of voluntary advance notice does not provide workers with the "best-practice" amount of advance notice (a minimum of 2–3 months)—as Chapter 7 notes, too few workers are notified in advance of permanent plant closures or large permanent layoffs, thus hampering their adjustment. When workers receive sufficient advance notice, the evidence suggests that they adjust more rapidly and more successfully to job loss, which reduces the costs of displacement to them and to the public sector. We believe that the benefits of advance notice more than outweigh the costs of such a policy—costs that exist, but that are distributed differently, when no advance notice is provided. When advance notice is given, the costs of worker displacement are shared by taxpayers, by the displaced workers, and by the firms closing plants or permanently discharging workers, rather than being borne primarily by taxpayers and the workers being laid off.

Through its public policies, this society has made a judgment that the costs of many regulations (e.g., those covering health and safety, consumer protection, or securities markets) that enhance the flow of information to workers and consumers and distribute costs more equitably among workers, consumers, and firms are more than offset by the benefits of such policies. We believe that advance notice falls into the same category of public policy and that steps to mandate this practice should be taken by the federal government.

Training for Labor Market Entrants

We share the concerns of other studies, set forth in the reports of the COSEPUP Panel on Secondary School Education for the Changing Workplace ("High Schools and the Changing Workplace: The Employers' View," 1984), the Task Force on Teaching as a Profession, of the Carnegie Forum on Education and the Economy ("A Nation Prepared: Teachers for the 21st Century," 1986), and the U.S. Department of Education ("A Nation at Risk: The Imperative for Educational Reform," 1983), regarding the amount and quality of basic skills preparation provided to labor force entrants by U.S. public schools. Improvement in the basic literacy, problem-solving, numerical reasoning, and written communication skills of labor force entrants is essential. We endorse additional public support for research on strategies to achieve this goal, as well as financial support for the implementation of programs that improve the basic skills of labor force entrants and of those already in the labor force who lack these skills.

Equal Employment Opportunity

We recommend more vigorous enforcement of policies to combat racial and sexual discrimination in the labor market as a means of improving the ability of minority and female workers, as well as minority and female labor force entrants, to adjust to the demands of technological change.

Science and Technology Policy to Support the Adoption of New Technologies

We support continued high levels of investment by industry and the federal government in basic and applied research—this is the essential "seed corn" of innovation, and such investments play a significant role in the education of scientists and engineers. Federal support for nondefense R&D is particularly important, in view of the limited commercial payoffs from the high historical levels of defense R&D in this country (there are important but limited exceptions to this generalization, as noted in Chapter 2). The foreseeable contribution of defense R&D to the civilian U.S. technology base appears to be limited at best.

In addition to a strong research base, however, public policies to support more rapid adoption of new technologies within this economy deserve consideration. The historic focus of post-World War II science and technology policy on the generation rather than the adoption of new civilian technologies (once again, a generalization with several important exceptions) contrasts with the orientation of public science and technology policy in several other industrial nations (e.g., Japan, Sweden, and West Germany) and may have contributed to more rapid adoption of manufacturing process innovations and more rapid commercialization of new product technologies in those nations. We therefore support the development and evaluation of additional public policies to encourage the more rapid adoption of new technologies within the United States.

We recommend increased federal support for activities and research to encourage more rapid adoption of new technologies. Although the achievement of this goal requires actions in a number of areas not considered by this panel, our review of policies leads us to recommend the following options for consideration:

- *Strengthen research on technical standards by public agencies (primarily the National Bureau of Standards) to support, where appropriate, private standard-setting efforts.*
- *Strengthen research programs supporting cooperative research be-*

tween industry and the federal government in the development and application of technologies.

- *Increase support for federal programs to improve U.S. firms' access to foreign science and engineering developments and innovations.*

THE ADEQUACY OF THE DATA

In the course of this study, the panel has found that the data available from public sources are barely sufficient to analyze the impacts of technology on employment. In some cases this data problem reflects the rapid expansion of new sectors of the economy, such as services, for which federal agencies have been hard-pressed to monitor and collect data comparable in quality and quantity to those available for manufacturing. In other cases these data have declined in quality during the past decade as a result of reductions in data collection budgets. The amount and quality of data on evaluations of worker adjustment assistance programs also must be improved.

- *We recommend that post-fiscal year 1980 reductions in key federal data collection and analysis budgets be reversed and that (at a minimum) these budgets be stabilized in real terms for the next decade in recognition of the important "infrastructural" role data bases play within research and policymaking. We urge that a portion of these budgets be devoted to improvements in the collection and analysis of employment, productivity, and output data on the nonmanufacturing sector of this economy.*
- *We recommend that a new panel study or a supplement and follow-up to the Current Population Survey be undertaken by the Bureau of Labor Statistics to examine the effects of technological change on the skill requirements, employment, and working conditions of individuals of working age. We also support the development by the Census Bureau of better data on technology adoption by firms.*
- *We recommend that the Bureau of Labor Statistics expand its survey of displaced workers (the special supplement to the Current Population Survey) to allow annual data collection and that this survey improve its question on the nature and effect of advance notice of layoffs.*
- *We recommend that any expansion of adjustment assistance services for displaced workers be accompanied by rigorous evaluations of these programs to provide information on the long-term effectiveness of different program designs and strategies.*

To reduce the potential for conflicts of interest that may arise when an organization charged with operating adjustment assistance programs has sole responsibility for the design and administration of evaluations of these programs, we recommend that federal or state agencies responsible

for the operation of such programs share with other agencies the responsibility for evaluating them, or conduct such evaluations with the advice of independent expert panels.

- *We recommend that evaluations be undertaken of the implementation of the provisions of the Perkins Vocational Education Act of 1984 that allow federal and state funds to be used for improving the skills of the employed work force. In addition, a federally sponsored evaluation of a sample of state-level programs in upgrade training should be undertaken to determine the overall effectiveness of such programs and the specific design features that contribute to success.*

Health and Safety Impacts of Technological Change

We recommend a major interdisciplinary study of the consequences of technological change for workplace health and safety and the regulatory structure designed to ensure that worker health and safety are protected. These areas also should be monitored carefully by federal and state agencies.

Recommendations for the Private Sector

Labor–Management Collaboration in Technology Adoption

Rates of adoption of new technologies, as well as the exploitation of computer-based manufacturing and office automation technologies to increase worker productivity, satisfaction, and safety, are affected significantly by the management of the adoption process. If the process proceeds smoothly, both workers and management can benefit from these technologies, which have the potential to enrich work as well as to enhance its efficiency. The potential payoffs from cooperation between labor and management in technology adoption are high, but such cooperation has been lacking in some U.S. industries. Our recommendations in this area highlight some key components of successful adoption strategies.

Elements of "Best-Practice" Strategies for Technology Adoption

- *We recommend that management give advance notice of and consult with workers about job redesign and technological change.*

• *We recommend that the adoption of new workplace technologies be accompanied by employment policies that strengthen employment security; such policies include retraining of affected workers for other jobs and a reliance on attrition rather than on permanent layoffs wherever possible. At the same time, workers and unions must recognize their stake in a more productive workplace and consider modifications of work rules and job classifications in exchange for such employment security policies.*

Protection from the Costs of Displacement

We recommend that management and labor explore the use of severance payments for permanent layoffs of experienced workers. To preserve such benefits in the event of a firm's bankruptcy, we also recommend that employers and workers consider establishing a joint insurance fund.

Education for Managers

We recommend that the current efforts to strengthen the quality of managerial education in the management, adoption, and evaluation of advanced manufacturing and service production processes be continued, both within business schools and through other institutions. Additional research on this topic is needed and could be funded through university–industry research collaboration, among other possibilities. Education for those currently employed as managers also must be strengthened to incorporate instruction in the adoption of new technologies and in strategies for helping the work force adjust to technological change.

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Statement of Anne O. Krueger

Advance notification of layoffs is undoubtedly beneficial to those workers who will lose their jobs. If there were no negative side effects associated with advance notification, it would clearly be beneficial to all.

There will be several side effects, however, if notification is mandatory. First, the necessary enforcement apparatus would increase the cost of doing business. Second, for all firms, but especially for risky ones, knowledge that layoffs could not be made on short notice would increase incentives to use capital and hire fewer workers. To the extent that fewer jobs would be created, the proposed requirement would hurt the employment prospects of those the proposal is designed to assist. That mandatory periods prior to layoffs can result in smaller levels of employment has been well documented in a number of developing countries. Third, requirements of advance notification reduce the flexibility of firms already in difficulty. The requirement is, in effect, the same as a tax for these firms.

I conclude that advance notification is desirable, and efforts to educate employers of its value to employees should be encouraged. With respect to mandatory notification, however, I believe that the evidence is far from sufficient to warrant such a step.

A

COSEPUP Charge to the Panel

"On the basis of present knowledge, the panel shall:

(1) report on the probable effect of current and future technological changes* on employment, focusing on the prospects for full employment and changes in the distribution of employment across occupations, social groups, and regions;
(2) report on the probable effect of current and future technological changes on the working environment, including probable impacts on labor-management relations, occupational safety and health, job skill content, and the length of the working day;
(3) report on the probable effect of current and future technological changes on existing and new employment opportunities, including probable impacts on wages, opportunities for advancement, and job security;
(4) identify economic sectors in which it is probable that the rapidity of technological change will cause significant transient effects for individuals and communities;
(5) report on the probable effect of current and future technological changes on the demand for employment-related training and education, including areas such as retraining of workers displaced by new technology, the continuing educational needs of professionals, and vocational education;
(6) identify and analyze the efficacy of existing and alternative public policies to manage the probable employment-related effects of current and future technological changes.

The panel shall also review the state of technological and economic forecasting methodologies and report on their potential for contributing unique insights into the employment-related consequences of technological change.

For those areas in which present knowledge is found to be insufficient to support a conclusion, the panel shall propose an agenda for research and other related activities."

*Wherever "technological change(s)" appears in the charge, it is to be understood that the term includes consideration of rates of diffusion.

Mr. MACKAY. Thank you, Dr. Mowery.

We will now take some time for questions. The order of questioning will be essentially that in which members came in: Mr. Packard, Mr. Skaggs, Miss Schneider, Mr. Lewis, and Mrs. Morella.

Mr. Packard.

Mr. PACKARD. Thank you, Mr. Chairman.

This was extremely useful testimony from each of you. I not only found your written material very well done, but also your statements were extremely helpful in terms of trying to understand how we can return to the competitive world.

There was some, I think, rather new and startling information relative to some of the causes. I think Congress has perceived some of the causes that your testimony has refuted. That is of great interest to me.

One of those areas was that—Yesterday noon Mrs. Schneider, and I think also Mr. MacKay, hosted a luncheon where we heard Mr. Brock speak. He made a statement that was repeated this morning.

That is that wage imbalance is not a fundamental cause of our international trade problems. It never has been, he said, and it probably never will be that the United States does not, has not and ought not to try to bring their wages in conformity with world market wages. I think that that is a very fundamental part of the way we operate here, that we're not competing on the wage scale worldwide.

You have expanded that, some of you, to where the unlevel playing field is not a major factor, as well as the quality control problem is not a major factor. I think many of us have felt that quality control has been perhaps a problem in some sectors. I suspect that it has been, but it certainly may not be the major problem.

Therefore, if America is to compete, we have to do it with higher productivity that will offset some of these other things. Then you have eluded to the dollar value as a major concern, and that economic deficits are probably more responsible than many of these other factors.

We have seen a lowering of the dollar in recent months. Are you seeing then the trends or the changing in terms of world competitiveness for the United States manufacturers that would normally go along with the reduction of the dollar value, where the dollar does not become a driving force for uncompetitiveness? Are those trends now following the pattern that you've outlined, some of you, in your testimony this morning?

Dr. Lawrence.

Dr. LAWRENCE. Indeed, we are seeing those trends. Last year, unit labor costs in the United States—partly as a result of the dollar, partly because of the fact that our manufacturing productivity growth was faster than any other major industrial economy—improved by 22 percent compared with that of our major competitors.

If you look at what has happened to the price of our exports compared to our competitors, you discover that with respect to Japan, we are now more competitive than we were in 1980. We are not quite back to the level of the Germans, but there has been a marked improvement in the fundamentals.

What about the flows? Over the last six months, American exports of goods and services are up 6.9 percent, just for a six month period. That translates to an annual rate in volume growth of 14 percent. One factor is that what happens when an exchange rate changes is that our import prices go up.

Therefore, in the short run it actually makes our trade deficit worse rather than better. Our costs rise. So that the dollar value of the trade deficit only starts to turn around with a considerably lag. On the other hand, if you look at the volumes, you get a clearer picture of what is happening.

So our export volumes, as I indicated, are up by about 14 percent at an annual rate. In the last two quarters, our imports are down in volume terms. These are not the numbers that you see when you look at the press, because what you get is a dollar value number. But in fact, measured in quantitative terms, our trade balance has already improved by $30 billion in the last two quarters.

Indeed, trade has accounted for more than half of the rise in our gross national product over the last six months. On the other hand, if you look at the nominal dollar values, you as yet only see small improvements. But you do see improvements there.

The short of it is that we are already seeing—if not to the naked eye, to the discerning eye—a clear improvement in the trade picture. It is the result of what has happened to the price of our products compared with those of our competitors.

There is a lot of debate among economists whether we've seen yet enough change in the dollar to put us back at something close to where we were in 1980. But I think there is a much broader consensus that there is a considerable improvement in the wings over the next two years, being driven primarily by the price of our products.

There are many other factors that will influence our trade flows, in particular the growth of our trading partners. But I would say predominantly, the effects of the dollar are at last being felt. They took a long time because foreigners had a large profit margin which they allowed to squeeze in the first year of the adjustment.

Mr. PACKARD. I'd be interested, Mr. Williams, and then anyone else who would like to speak on it.

Mr. WILLIAMS. Well, two shots of Brookings so early in the morning here is almost more than a body can bear.

Mr. MACKAY. Well, that goes both ways.

Mr. WILLIAMS. Let me talk a little bit about this if I might, just for a couple of minutes.

It seems to me what Dr. Lawrence is saying—It's wonderful to be assured that everything is okay and the world is moving forward as it should, despite all the evidence around us to the contrary, despite all these years of destruction and devastation.

It seems to me—I'd just like to make the point that Dr. Lawrence's evidence, going back to the beginning of his presentation, about how pervasive all of this is around the world—Dr. Lawrence argues that that proves that we're not in a low wage competition and an unlevel playing field is not an important consideration.

I would argue it proves just the opposite. The fact that these trends have been so pervasive everywhere in the world and everybody's been involved in that, it seems to me, underlines the fact

that we have been and are in a low wage competition in many ways, and we have been and are involved in an unlevel playing field in many ways.

Dr. Lawrence suggests that the only explanation for that is that there has been some kind of conspiracy out there. I don't think one necessarily needs to assume a conspiracy to be able to see and figure out what is clearly a worldwide circumstance.

We're feeling some optimism now because the dollar has finally come down. But let me remind everybody that the dollar was exceedingly high for a long period of time. It took a great deal of argument and all the rest of it to finally impress on the administration that something should be done about the value of the dollar. That, as Dr. Lawrence just indicated, takes a long time for any change to then be recognized.

Some of us are concerned about whether the dollar alone will ever resolve the problem entirely. To depend on one instrument, it seems to us, is somewhat reckless. Dr. Lawrence just mentioned the high profit margins that other countries have had. There is also an element which he didn't mention.

That is, for other reasons—for reasons of driving employment, for reasons of having some dollar income at whatever price—there is all kinds of evidence out there that many trading partners are willing to export into this market, even at a loss, for other purposes, simply as a market driven situation. Many of these people who are shipping materials—steel and other items—into the American market are not operating from market driven economies and have many other considerations.

The fact of the matter is that we live in a world where technology is totally mobile, where management skills are totally mobile, where capital moves around the world at a pace that we really can't keep track of any longer, where what isn't mobile is workers and communities and wage levels and so on. The fact of the matter is that the very real pressure all of us on the front lines have felt in our collective bargaining and in every situation out there is our employers pushing and driving away at us to lower our wages, to lower our incomes, to lower our standard of living.

I've had chief executives take me aside quietly in the back room and say Lynn, you must understand that we're living in this global economy, and if we cannot produce in America at rates and ways that are competitive with what we can do in other countries in the world, we will produce in other countries in the world.

And the evidence is all around us that they do. And the evidence is all around us that they move to those other countries to seek advantage of the low wages in those other countries.

For us to sit around with this degree of sophistication and pretend to ourselves that what's right there in front of us is not the fact, I find somewhat mind boggling. I just find it impossible.

If I can just say a word about the unlevel playing field. Sure it's true, we've had some more elements of protection in the American situation in recent years. We've had to out of desperation. We've had interference in steel trade with the voluntary restraint agreements. But the blunt reality is that if we did not have those voluntary restraint agreements in place—We complain about them constantly because they haven't achieved their objective and they

aren't administered—they're administered reasonably well, but they haven't accomplished what they're supposed to accomplish.

Let me say that if they weren't there, there would just be total devastation in the steel industry in the United States. We've had to do these things in order to manage world trade and manage trade in some of these principal sectors with some degree of effectiveness and some degree of protection for what exists in America.

One final quick point. I guess I'm kind of doing a quick rebuttal to Dr. Lawrence. He points out in his one graph, his thesis is that there is no deindustrialization in America. Again, I appeal to common sense.

You look across industrial America and you see devastation. You see plant shutdowns. That's why we're worried about advance notice of plant shutdowns. We're shutting plants down all over the country.

If you take out of what we're manufacturing, if you take the military piece out of it, that's what worries a great many of us so much. You take the military piece out of it and leave the commercial piece, and then you get a much clearer picture of how we are deindustrializing in terms of our ability to compete in this global economy and to really produce goods and have them out there in this global economy. This situation is much grimmer and much more difficult.

Mr. PACKARD. I'm taking much more than my five minutes. Dr. Ginzberg.

Dr. GINZBERG. I thought that Lawrence gave away too much. I don't agree that we should be that optimistic. I think the United States is not paying its own way at the moment, and that means there is inevitable trouble ahead.

That is, we are living off the foreign imports of capital. We can keep doing that for a while, but I'm very restive about the fact that we are living beyond our means. It's as simple as that.

That is obviously a piece of the earlier trouble with the dollar being so high, and it's going to be a further piece of trouble as we get down the line.

I would like to say to Mr. Williams that I am particularly sensitive to the fact that a lot of people—many more than we've ever known—are getting hurt by virtue of these wrenching changes that are going on. I don't think we have even seen the beginnings of a point that I didn't make, which is that the new technology has made the international labor markets a more integrated market.

A fair number of American computer companies are having their software written by Indians in India because it is much cheaper to get it written there than it is in this country. There is nothing to stop it. I do some consulting work for one of the very big computer companies. They have a design unit in Jerusalem tied in with their Massachusetts affair. They "get better people there for a lower cost" than they can in Massachusetts, for whatever reason that is going on.

I don't really think, however—and that's the trouble—that you can simply say that American industry has been in trouble only because of these worldwide affairs and that none of the trouble rests on its own head.

I had a long discussion with Mr. Gerstenberg when he was head of GM in 1972. I said, what the hell are you doing about small cars and imports? He said, we're doing nothing. Americans love big cars and we don't think this is anything, just some yuppies who are interested in it.

Well, you know, if you have that level of management, I couldn't agree more with Mr. Strassmann. I wrote a book with the executive vice president of Bankers Trust, George Voyter, called Beyond Human Scale: The Large Corporation at Risk. If you don't know how to manage your resources—steel is an outstanding example of what they didn't know what they were doing for 25 years.

Now, it's too simple to simply say that there's something going on over there. We got into very bad practices in this country. From 1945 to 1965 we had no competition. And we thought we were good. In fact, we were lousy. That's a really very tough concept to get, and we're working ourselves out very slowly, very slowly.

I would say that Lawrence gave away his macro issue. I think we're still in very serious troubles in this man's economy.

Mr. PACKARD. Mr. Chairman, I have many other questions but I feel I should yield to some of the other members.

Mr. MACKAY. Let me just say, nobody should feel guilty about the amount of time this has taken to get to the discussion section. We're the ones that invited this many witnesses because it's this big a problem. So I feel very good about where we are.

Mr. PACKARD. I'll yield to the other members in their order, and then I'll come back after they've had their word.

Mr. MACKAY. All right, fine. Mr. Skaggs is next.

Mr. SKAGGS. Thank you, Mr. Chairman.

I guess I would like to provoke a little bit further discussion among you about one of the issues that will be coming before us shortly, which is the plant closing legislation.

On the one hand, I feel myself responding very much to the arguments of basic social equity that Mr. Williams made, the arguments of economic efficiency that Mr. Mowery made. And yet, also to the criticisms of Mr. Strassmann that here we go devising a tool to deal with the average and with the manufacturing sector perhaps more than one that is appropriate across the board, although the legislation would apply across the board.

I'm wondering if I could ask for a bit more of a debate among those three or all of you. How do we fashion the tool that gets at the very desirable social and economic objectives laid out without being too blunt an instrument, and one that also hamstrings very necessary adjustments to changing economic conditions?

I've heard business people time and again say, how can we foresee in a changing market environment what position we're going to be in sixty days from now? How do we really make that sort of thing happen fairly to all parties?

Mr. WILLIAMS. Well, advance notice, it seems to us from our point of view, is simply common sense. We think in most circumstances businesses surely have a vision of longer than sixty days. We're talking essentially usually about 90 days advance notice. That's what we're talking about in the legislation. That's what we negotiated in many instances.

It's the beginning of some rational recognition of assisting in transition programs and all the rest of it. There have always been a couple of standard arguments against it which I think evidence in every other country and evidence which we have here in terms of collective bargaining experience has really negated.

There always was a suggestion that if people knew they were going to shut down they wouldn't pay any attention anymore, they wouldn't do their work, they would all run away some other place. The truth of the matter is that people work harder in all these situations, usually in some desperate attempt to try to have their employer understand that they ought to continue the operation or something.

But the fact is that people don't run away and don't work. They do just the opposite. We don't see a downside to it.

Dr. Mowery can speak to it from a more objective point of view. But I understand his commission started out that if there were any sense in it they were opposed to advance notice, and came to the conclusion from their own examination that the kinds of things I'm saying are in fact the case.

Dr. GINZBERG. I'm surely in favor of it. If you can have management have all kinds of these golden parachutes, the least you can do is if you've had a worker for 25 years on your payroll, to give him a couple of months notice.

I think from my studies way back in South Wales in the coal mining areas in 1939—that's how far those studies go back—one of the most important things is to communicate as early as possible to workers as much reality of the changes that are going to face them as possible, because they will then begin to do something about it.

The trouble why TAA didn't work—and my old commission looked at that in great detail—was you only got the benefits about 15 months afterwards, and that sort of kept everybody from doing anything about changing his circumstances.

So I am overwhelmingly in favor, just on the minimum basis of equity, to try to get some advance notices, and to make sure we don't go back to the old-fashioned TAA system. I would go with the NAS study.

Our commission also found that you couldn't really differentiate what was technology and what was trade and what was just bad management. If you are going to have a benefit, you had to give it to everybody. It just didn't make any sense otherwise.

Mr. MACKAY. By the way, we understood you didn't agree with each other when we invited you. And that's why we invited you. [Laughter.]

So, we are gaining from hearing the expressions of your views. Let's just go from my right to left, Dr. Mowery, and then Mr. Strassmann, and then Dr. Lawrence.

Dr. MOWERY. With respect to the point about do all businessmen or business people know that they're going to close and whatnot, I think our panel considered this issue and recommended that allowances be made for exempting small firms, firms of, say, between less than 50 to 100 workers, and some allowance for unforeseen business circumstances.

The thrust of the recommendation in the Panel on Technology and Employment's report I think is that where there is informa-

tion on one side of this labor market transaction, let's get it equally distributed, as we do with consumer protection legislation, as we do with securities market regulation to regulate insider trading. Clearly there are going to be sudden unforeseen circumstances and those have to be worked out. But the thrust of this recommendation is for distributing the information as equitably and as widely as possible.

Mr. MACKAY. Mr. Strassmann.

Mr. STRASSMANN. I am opposed to the plant closing legislation both because it is impractical and it doesn't deal with the problem at least on two grounds of feasibility. First, 90 days is just not enough for somebody to be able to reconfigure their life. So, I think it is falling far short of really being a helpful solution to a much deeper endemic kind of a problem. If you are a chemical worker or a steel worker, 90 days just won't do much for you.

My feeling, based on study, is that those companies that are involved in gain sharing where, in fact, the workers have much greater understanding and information about the profitability of the company—and we have a number of very successful examples of that—those workers have a long-term understanding and information about the competitive viability of the firm, and they are able on a long-term basis to make judgments which are necessary to adjust their whole style of living and their direction and exercise individualized choices.

So, I feel that taking isolated measures is sort of the usual industrial way of looking at legislation that you find in isolatable administrative kind of a measure, and then you are imposing on top of all the other measures would just well give additional employment to all the firms who have to now consider plant closing as part of their management processes. There will be legal counsel and opinions. All profit plans now have to be reviewed by lawyers, and it will just increase overhead and decrease productivity in America.

Dr. MOWERY. Could I just make one clarifying point with respect to our recommendation?

This was, as Mr. Williams said, extensively discussed by the management representatives on our panel, most of whom had extensive experience with providing advance notice, and none of whom felt that it contributed significantly to the costs of doing business relative to a wide range of other factors. That was their opinion based upon extensive experience.

Mr. MACKAY. Mr. Lawrence.

Dr. LAWRENCE. Let me just say my view is that closing, of course, isn't a panacea. But I am struck that none of us find it very peculiar that in the property market a landlord is required to give the tenant 30 days' notice. We sort of take that as almost a norm. And I believe that the same kind of norm of just basic human decency—the fact is that a job is more important to people than where they dwell probably. And it just seems to me that dropping people, particularly when it's en masse, in an environment is just something which is basically inhuman. And so, I think it has an efficiency cost.

But I also believe that there are times—as I say, I haven't seen the property market come grinding to a halt as a consequence of

mandatory advance notification for property, and I would do the same for plant closing.

Mr. MACKAY. Mr. Compton, one of our advisory committee members, would like to make a comment.

Mr. COMPTON. Mr. Chairman, in regard to the question from Mr. Skaggs, I think everyone that has experience with employee involvement and with the value of information the employees can feel a certain association with this and the need for it.

On the other hand, I just would like to point out there are two ways of accomplishing a social good. One is by legislation. The other is by incentives. And I would hope that the Congress would look at both of those mechanisms before you come down on the hard side saying this is a strict way of having to proceed.

Mr. MACKAY. All right.

Mr. SKAGGS. How might you make——

Mr. COMPTON. Oh, there is a variety of ways. You would know better than I, but having to do with tax incentives, having to do with a variety of pieces from other activities.

Miss SCHNEIDER. I don't feel that that is a really substantive answer. So, if you could please give us more specifics, I think you are touching on a critical point.

Mr. COMPTON. Well, I think you can design a program for which there is a clear cost to not doing something, and that cost has to do with the costs of the employees that might be laid off and the responsibility of that firm for those. And you can then leave it as whether the populace as a whole will, in fact, take that cost or whether the firm will. And you can, in fact, I believe build into that an incentive. It makes the firm look at what their cost tradeoffs are.

Mr. MACKAY. All right, now we have reached a crisis. Dr. Ginzberg has got to leave in eight minutes. Mr. Price has got a question specifically to him. Let me allow Mr. Price to ask the question, and then Dr. Ginzberg, if you will, make whatever summary you would like to make plus an answer to his question. And then we'll go next to Miss Schneider who is the next person to ask questions.

Mr. PRICE. Well, let me apologize. I have had to be in and out of here this morning, and so if this has already been addressed, please just say so.

But in your testimony you talked about the education requirements that these service economy jobs required, and you used the term functional literacy implying that we needed to reconceptualize the notion of literacy and what that might mean in this new economy. You say here it requires 12 years of effective education, but you don't really elaborate to any great extent.

I wonder if you could say a word about what literacy might mean and worker preparation might mean in this new economic context.

Dr. GINZBERG. As far as I can see from my New York base, we have six out of seven jobs in the service sector in New York City. The New York Times had a report the other day that the banks had agreed to take some youngsters out of deprived schools, and if they did some decent work, they would take them into the bank, guarantee jobs. And these were high school graduates, and they were not able to do arithmetic at the eighth grade level and so that half of them couldn't—the banks could not fulfill their commit-

ment because the youngsters were not able to come beyond the eighth grade.

My own view is that at this stage of the game, one has to have for most white collar work that I see going on in New York with financial, insurance, retailing and so on, you need something approaching a high school graduation. Now, it is unbelievable, but in this country which has this long history of public education we are failing in terms of the minority populations in the inner city. And this is all through the United States. Something of the order of 40 to 60 percent of black and Hispanic youngsters do not come up to high school graduation. And that is a major structural problem. And the Prime Minister from Japan did not say it very discreetly when he was here, but that is what he was driving at. We have a whole section of our population that is cut off from the new work force. That is the single most serious problem that I see in the American economy today.

And that means that since I don't believe we can restructure the elementary and secondary schooling very quickly—my colleague used to say it took 40 years to get an innovation into the educational system—we have to have second and third chance opportunities. In World War II I was in charge of a considerable part of the teaching of illiterates. They weren't total illiterates. We took them in the Army—300,000 of them. And we brought them up to snuff pretty quickly. That was one of my Eisenhower studies called "The Uneducated."

So, I think from the point of view of the Congress, I would say while it is very important I think, just common equity—I would agree with Lawrence—to have dismissal notices, the fundamental issue I think from the Congress ought to worry about that significant part of the U.S. population that is not being prepared to work in the U.S. economy. That is the overriding issue.

Now, I would simply say very quickly in my own summary that I am very worried as Strassmann was about bureaucracy and the lack of effective management. But I wouldn't blame that on technology. See, I think a very big technology like computerization takes a very long time to permeate. The automobile is 102 years old, and it took us not one generation, but two generations to get people to learn how to drive easily and to get the right products and to get it all worked out. And it took a half a century to get the trucks to compete with the railroads, et cetera. So, I would argue that in thinking about fundamental technologies—and computerization is one—you need a very long time perspective.

I think another thing that is important is that I don't think from what I've had to do with manpower policies in this government—we don't get a very good return from Federal funding which has to deal with a very diversified economy. We really need a lot more opportunities for the states to become very prominent. It really ought to be much more of a Federal-State relationship. This is a continental economy. And what goes for New York doesn't go for Los Angeles, and what goes for Los Angeles doesn't go for Minneapolis. So, you have to begin to think very much more.

I'm carrying on a major research project now for the Ford Foundation, which is looking at four major metropolitan areas, the four largest: New York, Chicago, Los Angeles and Houston. Those are

four different worlds as far as the labor markets go. And unless you can get the Federal Government to work out a whole set of support systems in which the states play a dominant role, you are going to get very low returns on your dollars. I think that is a very important thing to remember.

So, I would say of the other things that I heard around here, I was attracted by Lawrence's notion about some kind of way to provide some kind of wage support for elder workers who have had very good jobs for 25 years or so. I don't think it would work quite as well as special early retirement. I would find that a more easy mechanism. And the Europeans do that all the time. They simply say at 55 or at 58—I wouldn't go very far down, but surely at 58 to 62—that's four years—it wouldn't cost us much, and it would be much more humane to do that, to simply qualify a worker with 20 or 25 years' experience where the plants close to say, okay, if you want to, you can go on to Social Security at that point. It looks to me like a minimum kind of a thing that a civilized society ought to be willing to do. So, advance notices and at least early retirement look to me to be two possibilities.

I would like to put some money for counseling and for information about where jobs might be. And we used to have something in the Federal legislation about even giving some money to let people visit some other labor markets and come back. We never used it very much, but I don't think it is a totally impossible idea for these displaced workers. I think somebody who has worked 25 years in an industry is entitled to some public support system of some sort or another to help them at least get back into another part of the economy.

Mr. MACKAY. I would like to say I first heard you—I think it was probably 15 years ago—when we were trying to revamp the Florida education system. Our reform has since been reformed twice. So, there is something philosophical to be learned about education reform, as you suggest. I look forward to hearing you 15 years from now.

Thank you very much.

Miss SCHNEIDER. I would like to make one comment to Dr. Ginzberg just very briefly. I apologize for being late to this morning's hearing, but I was in a Republican conference where what was being aired was a reflection of the frustration of the Republican Party in dealing with the bureaucracy and accomplishing different things.

Let me say that very clearly here the image that comes to mind in listening to the conversation here this morning is that you are looking in terms of Mr. Williams and Mr. Strassmann and the members of Congress at three separate entities that are trying to keep a boat afloat. You have labor, you have business, and you have government. Some of us are paddling the boat. Others of us have our little bucket, and we're trying to bail it out.

Where you gentlemen from Brookings and the National Academy and you from Columbia I feel have an advantage, number one, and number two, is a responsibility is that we need some guidance. We don't have the time, as we are bailing or paddling or whatever it is we're doing to come up with creative concepts to solve the problem. And my greatest frustration is that crises management

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seems to be the norm here. And the other greatest frustration is that creative new ideas do not come fast enough.

And so that if you have new ideas as to how we can solve these problems, let me say that your Ford Foundation report will have minimal impact unless you bring a copy of that study and hand it to Claudine Schneider or hand it to Buddy MacKay and say, here is the road map. Here's the path. Go for it.

Mr. MACKAY. He'll do it too.

Miss SCHNEIDER. We would appreciate that kind of cooperation.

Mr. MACKAY. Thank you very much for making this effort, Dr. Ginzberg.

And now, having finished her editorial, I will recognize Miss Schneider for her questions.

Miss SCHNEIDER. Thank you. Well, my question is based on some other comments Dr. Ginzberg was making. I think that he pointed out that we have to look within ourselves, not to keep so much an eye on Japan and other nations as to everything they are doing. I mean, if we look at our trade imbalance with Japan, which is about $60 billion, and we look at the amount of unfair trade practices that are involved or different advantages that they have, that only accumulates to about $10 billion of that $60 billion. The fact remains that there are a number of other strategic paths that we must follow.

And this is the purpose that Buddy MacKay and I have taken to form this Competitiveness Caucus so that we could lay out some kind of road map that is broad enough to say that, well, we just don't want to focus on currency and capital resources and the value of the dollar. We don't only want to focus on trade policy and whether the Japanese are unfair or not unfair, but we want to do both of those things. Thirdly, we need to look at our science, research and technology policies and understand that our knowledge base is one of the legs up we have in this process. And fourthly, the other area of key concern is to put great attention on the human resources. And that is primarily what we are discussing here today.

But culling all of that information down, I'm curious to know from the panel members—we all agree that we have to work on basic skills. Yesterday at our session with the Competitiveness Caucus during the morning business was saying very clearly that they don't feel that it should be their responsibility to do the education and training, but yet many of them have taken on that responsibility because they see that's the only way the job is going to get done. They can't depend on the Federal Government or the local governments to satisfy those needs.

So, my question to all of you is what is the best policy in terms of addressing training, who should take the bulk of the responsibility, and how should it be done. And the second part of the question is—let me ask the first one first, and then I'll ask the second part. All right, get the answers. Who really should take the bulk of the responsibility for this training? Considering we are playing catch-up right now, how do we go after the 55 year old steel worker that is essentially functionally illiterate? Who needs to take care of him?

Mr. MACKAY. Why don't we start in this case from my left?

Mr. WILLIAMS. Well, I think everybody has to share the responsibility. Let me say a quick word in defense of the 55 year steel

worker. I wouldn't describe him quite as functionally illiterate if——

Miss SCHNEIDER. I wasn't picking on the steel workers.

Mr. WILLIAMS. No, no. That's all right.

Miss SCHNEIDER. It could be a 55 year old machine tool worker, which I have encountered many of in my district.

Mr. WILLIAMS. If one wanders into a modern steel plant or a modern machine tool plant, why, one will see a great many people working in control booths and working with computers and involved in quality control exercises of one kind or another which are reasonably technical and so on.

But to return to the point, in training and education I think we just have—everybody has to share part of the responsibility. Part of my theme here this morning that I might return to is that we need more mechanisms where we all are involved, labor, management, and government, in addressing these problems.

Lester Thurow I think puts the—he talks about this problem a great deal. And the way he described it is he says from the middle—the top half of the work force in America, we do a great job. Our universities are world class, and in all of those ways we're competitive. From the middle down we do a very poor job. And we do that poor job in a variety of places. We don't do it too well in our school system for reasons that have been discussed here already this morning. On the industry side of it, we don't do in-house training nearly as well.

We have had a terrible struggle over the years, for example, with our industries for the most part in developing advanced enough apprenticeship training programs and keeping them in place in times of stress. They're sort of the first things to go when there is some pressure on the industry. If we contrast that with what happens, say, in a country like Germany where you have a different approach, but a very successful economy in today's world, why, they have had a continuing emphasis and involvement at the industry level in rather detailed apprenticeship programs.

So, I think there is a responsibility for everybody. Our training, as was mentioned, for displaced workers has been hopelessly inadequate. I think 6 or 7 percent of the work force was the number used. I've always said about 5 percent, but we know on a common sense basis it doesn't touch very many people. And again, it comes very late in the game, and it is not adequate in terms of income supports while the people are involved in training. And it needs a focus in both directions. There are arguments out there in training, well, we should be training people for jobs, and some of our own people sometimes resist training because there isn't a definite job at the end of it.

Our view in the union has always been that we need to do both things. We need to try to focus in terms of results, try to relate training to job prospects that might be available, try to work at rebuilding industry in a community and training together, but on a parallel track they shouldn't be considered tracks that are one in opposition to the other. We should be working at the basic skills. We should be working at language, at education, and at computer literacy.

The way I talk to our members about that all the time is, look, it would be so much more useful for anybody who is laid off from work, if there's nothing else to be done, to improve their language skills, improve their mathematical skills, and develop some degree of computer literacy. It can't be anything but helpful in terms of their own personal future, and in terms of improving the quality of the human resources available in our society.

Miss SCHNEIDER. All right. Well, I would assume that there is a consensus, that everyone believes that we all have a part to play in the basic skill level.

Yes?

Mr. STRASSMANN. I have a slight variance.

Miss SCHNEIDER. Okay.

Mr. STRASSMANN. I feel that the primary responsibility for education is in the hands of the individual because if the individual does not have a deep incentive and commitment to education, it won't happen.

I think what is fallacious in our view of education is that traditionally we have looked at education as a public good. In fact, I look at education as a capital investment. In the white collar work force the knowledge base deteriorates at the rate of total depreciation every seven years because of the change of technology.

Now, once you start reconsidering the fact that wages are really partially a return on labor and partially a return on capital because part of what you are getting paid for is return on your invested educational capital, and you start visualizing a tax code that will recognize education investment as a depletable capital investment, I think you are suddenly going to start positioning yourself with a completely new structure for giving incentive for education based on individualized asset ownership.

And I think once you start thinking in those terms and Congress starts thinking in those terms, you may come up, and most likely will, with a totally new education policy for the United States.

Miss SCHNEIDER. Let me ask Dr. Lawrence and Dr. Mowery the following question. One of the things that seems to surface regularly is the frustration and the amount of money that the Federal or local governments are putting into education and what the students are getting out of education. Rhode Island, the state that I represent, has one of the highest per teacher salaries in the country. Yet, unfortunately, our students have some of the lowest SAT scores, et cetera, et cetera, which only attests to the point that you are making, Mr. Strassmann, that the individual I believe has to really be committed to a great degree.

But there was a suggestion yesterday, and I have heard this before. Some have said that our government policies should provide for such things as tax incentives so that businesses will invest in the human resources in training and retraining. Yesterday the emphasis was, no, we're just pouring money down a hole because we have no way of measuring the investments that are made and the return on those investments.

What was suggested instead was to have something comparable to a block grant whereby if Xerox decided that they were going to educate or train their people, they would put up matching funds or even not a Xerox. Let's just say, you know, O'Leary's Machine Tool

Company decided they wanted to retrain some of their workers. They could apply for a matching grant, and then there would have to be some kind of test or measurement that once those employees had had advantage or had taken those funds that they had improved their skill level.

I don't know how to deal with that. I mean, do our academician panelists have some suggestions?

Dr. LAWRENCE. Well, I think it is very hard. I think if you start off thinking about training as having two components, a specific component and a general component, that someone who goes to work for a firm learns some skills that are simply not transferable. Now, ideally and probably in principle, what you will find is that the firm will tend to concentrate on providing that person with those specific skills. And indeed, there is no reason why the society as a whole should be subsidizing the acquisition of those specific skills.

On the other hand, when a firm gives a worker something which they can then use in order to better themselves, but not necessarily with that firm, there is a spill-over. It is much more difficult for the firm. We don't have indentured servitude. Thank goodness. So, firms can't capture those workers, and so it is much more difficult to do.

My own sense is that we ought to look at this thing as an investment, that we ought to recognize that the market for financing this particular investment is terribly imperfect. Why can't I—if I get into Harvard University, why is it true that even though everybody knows that's a paying investment—some people may dispute it, but let's just assume it's paying for a moment. Why can't I go in and get a loan? The reason is that there is no security there. There is no security behind it. The individual bank will not give me the money unless there is some kind of government intervention.

Now, my own view is that imperfection in the market for training really is an area where the government has a role to play. You see, whereas a bank can't obtain your future earnings, the government can because everybody files tax returns. My own proposal would be that anyone who wants to invest in training in the United States, in education in the United States, should be able to obtain a loan which they would then pay back contingent on their future incomes. After all, why do we finance everything or many investments in education using debt, a fixed payment? I believe that the government should be taking equity in its citizens.

So, my proposal is, just to make it clear, is a contingent repayment plan where anyone who wants to undertake training in a recognized institution, be it for higher education, be it for later training, would obtain the money from the government and would then be liable for paying it back through their tax returns contingent on their future income.

Miss SCHNEIDER. Well, wait a second. I have to interrupt you because it seems to me that that is all right for a person who has, number one, the intellectual competency to apply to Harvard, and number two, who has the financial resources even with the idea of borrowing part of it. But what about the person who is living on the fringe, the middle and lower income individuals?

Dr. LAWRENCE. I beg your pardon.

Firstly, I think all people realize—and the best indication that a person is going to be motivated is that they at least can enroll in a course. I'm talking about a community college as well. I'm not just talking about Harvard. And I'm not talking about only giving them partial resources. I'm suggesting that they should be able to get a loan which will allow them to enroll in the training. After all, if training is going to add to their incomes, and the government can take a share in that, I think you should be able to operate this and not necessarily with large amounts of concessional financing.

Dr. MOWERY. Let me talk briefly to your question about the justification for subsidizing firm-provided training. This is an issue that our panel considered at some length, and we could not resolve or come up with a mechanism I think that would prevent subsidies from being used for training that would be provided anyway, essentially substituting for firm-provided expenditures.

And I think that where we came out on it is that we need to know more about how the existing programs, of which there are a great many at the state level, are operating, and what impact they are having. And indeed, even within the Federal establishment under some of the provisions of the Perkins Vocational Ed Act of 1984, the power exists for Federal monies to be used to support training within firms.

There has been in this area, as in most of the other areas of retraining for displaced workers particularly, too little evaluation of what works and what doesn't. And I think particularly with all of the state level experiments operating now, the area is ripe for some very good analysis and comparison because there is some evidence that in some programs you are finding that corporate funds used for retraining are essentially being displaced by some of these subsidies but there are countervailing examples as well. I think we just need to know more about it.

Mr. MACKAY. All right. Mr. Lewis.

Mr. LEWIS. Thank you, Mr. Chairman. I must apologize also for being late, but I found that since I've been in Congress, one of the greatest problems I have is managing my time. And it seems like I wake up and start off late, and I continue to be late the rest of the day. And I don't think you have an answer for that at this point in time.

However, I had a series of questions I wanted to ask Mr. Strassmann, but I just wanted to talk a little bit about the training and the labor-management-government aspect that Mr. Williams brought out and discuss that with all of you just for a moment or two. I am sorry Dr. Ginzberg is not here because I certainly did want to discuss a few things with him.

I heard Dr. Lawrence pointing out several things, and also Mr. Williams, about the training that we should have and what the government's responsibility was. And Dr. Lawrence, I certainly was elated to hear you point out the individual's responsibility, and you as well, Mr. Strassmann, because industry over the years has on a number of occasions tried to work with employees and set up training programs. This was prevalent when computers came into being and new computer technology and management and software programs, and tried to cross-train those types of employees that had the aptitude to do that.

And I think one of the greatest problems we get into with government—and I think the CETA program was an excellent example of the stupidity of the government to set up a training program. And it was used as a welfare program basically rather than what it was intended for. And that is unfortunate.

And I would like to ask Mr. Williams if you could tell me if we get into the training business here in the government and try to help those individuals, and I would say, who do not have the aptitude to cross-train into the higher technology areas today, how can you control this government-wide, to keep the bleeding hearts out, is what I'm asking? How do you do that and really get into a training program that is going to help these people?

Mr. WILLIAMS. Well, I think there are a great many examples of successful training efforts. There are a great many examples in terms of various industries. There are some unions that have been much involved in training. There are some projects in terms of retraining like those in the automobile industry that have been negotiated with the UAW and Ford and UAW and General Motors.

Mr. LEWIS. I'm speaking of the government's application in this area.

Mr. WILLIAMS. There are many success stories in the JTPA in terms of individuals. We have tried deliberately in the Steel Workers because we have been negotiating with essentially companies that haven't got any money to spend really, and they're in great, difficult circumstances. So, we made a deliberate effort to try to make as much use of government finance out there as we possibly could.

And we have had a number of joint job search programs. We have had a number of joint job training programs. We have a number of them going on now. We have quite an elaborate setup in Ohio, relatively speaking. We know there are a great many people out there interested in the training, who take advantage of it, who learn things. The whole problem has been that the resources available for this have been so limited in relation to the need.

Now, of course, anything you attempt to do, things can be well managed or things can be badly managed. And I think Mr. Strassmann has given us an interesting insight this morning in terms of bureaucratization and all of these elements. And believe me, that is not a problem just confined to government enterprises. There has been a great deal of that in private enterprises too. That's something we have to struggle with. But because there may be some challenge in managing a program well doesn't mean that the program shouldn't be done and shouldn't be attempted.

I think one of the things we have learned in this period is that worker involvement, information, a sharing in terms of the management of these things helps everything we do, helps in the private enterprises, helps in the public enterprises.

Certainly I think one of the reasons that our modest efforts have been successful is that the union, the workers, and the company and the JTPA effort—there has been joint involvement in doing these things. I think there are models out there, and there are models in other countries that could be very helpful to us. I don't think it is an impossible task at all. That is not to say that it

doesn't have to be done carefully, and it doesn't have to be well managed.

Mr. LEWIS. Mr. Williams, I don't think anybody in this room would disagree with what you just said. I think that is fine.

Mr. STRASSMANN. May I strongly agree with Mr. Williams?

Mr. LEWIS. Pardon?

Mr. STRASSMANN. May I strongly agree with Mr. Williams on the subject of worker involvement. If a portion of compensation of the work force comes from productivity and there is productivity gain sharing, you automatically achieve the information transfer function because in order to compensate based on productivity, the workers have to learn a great deal about the enterprise. And it's a great university of understanding how an organization can be more effective. So, I certainly agree with that view.

Mr. LEWIS. I would like to ask Dr. Mowery if he can elaborate on some of the things Mr. Williams said.

Dr. MOWERY. Yes, let me just make one point in response to your comment.

I think in talking about adjustment assistance for displaced workers, you have got to keep things in proportion in terms of the relative importance and utility of retraining and other services.

What this panel for which I worked proposed was a range of services, part of which would be training in basic skills and retraining in job-related skills. But there are a range of other services that are equally important, like job search assistance, counseling, and skills diagnosis for displaced workers, people who may never have changed jobs or may not have changed jobs for 20 years, who have never been out there trying to find a job, so that while retraining can help some individuals and traning in basic skills, although we don't have direct evidence, surely must be beneficial for those displaced workers who do not have strong basic skills. These other services are equally important, and we should not make the mistake of lumping all of worker adjustment assistance into the retraining category.

Mr. LEWIS. Well, I agree with that completely, Dr. Mowery. I was a part of a task force several years ago to set up a cross-training program, and one of the greatest problems we had was educating the people that we were going to cross-train that they were not going to lose their job, but this was to better their job. And I was impressed with your comment to take computer technology and mathematics and that sort of thing, and we used that technique. It was partially successful, not completely, but we were dealing with a very semi-skilled level of worker that we were trying to upgrade.

Mr. WILLIAMS. And if the workers are involved in designing the programs——

Mr. LEWIS. We did have that, yes.

Mr. WILLIAMS [continuing]. If they are just being presented to them, I think it can do a great deal to allay other concerns and other fears, some of which may have to be dealt with directly. Workers have reason from their experience to be suspicious of many schemes which may seem designed to sort of do them out of a job and so on.

Somebody mentioned here the job is the most important thing people have. And I would add I guess that the further down the

income scale you go, the more that is the case. If you haven't got very much, and whatever you have is dependent on the job you have, then you are going to look a little carefully at who is coming along with what scheme and for what purpose. And one of the things that is most important in dealing with that is for the workers themselves to be involved in designing these programs and to be part of it.

Mr. LEWIS. If I may, Mr. Chairman, I would like to discuss with Mr. Strassmann just a moment. I noticed in some of your comments the productivity of the information sector has steadily declined since 1974.

And it has been my experience since the computer rage hit our industry that we are buying a lot more than we actually need for the purpose that we are trying to obtain. I have computers in my office, and we also have computers in the private sector that everybody has to have one now in order for them to do their job. But the only thing they're doing, they are storing more information which 90 percent, maybe 85 percent, of that information they don't even need and never will need. But this computer can do everything.

And I have a young lady that works for me in the private sector that she is strictly a believer in memory typewriters. I can't switch her over to a MacIntosh or an IBM PC or what have you. And she actually produces more than the people that have the computers.

And I just wonder where the breakpoint is in this area so that we can see the information worker increase their production. Do we really need all of the additional apparatus that we have for them to do their job today?

Mr. STRASSMANN. Mr. Lewis, the issue is not the apparatus. The issue is the workload. See, what happens is when you study organizations as I have, organizations breed unnecessary work. And so the underlying problem is the generation of staff work and additional functions that have to get additional copies to review so they can go to their word processing equipment so they can write clever letters of comment.

So, we have created a breeding, a work breeding, paperwork and information breeding machinery in the United States which is unequaled anywhere in the world by any ratio that you can look at. We deploy a larger proportion of our national assets on manipulating and shuffling information that doesn't produce anything.

And therefore, the issue is not whether she keeps a memory typewriter or goes to a personal computer. You see a memory typewriter producing 300 unnecessary letters a day is not 10 times more productive than an old typewriter, a Remington, producing 30 unnecessary letters a day.

Mr. LEWIS. That's true.

Mr. STRASSMANN. And so, I think the congressional concern about technology really should go to the roots of what I consider unnecessary overhead generation that we have imposed as a cultural and structural requirement on our civilization.

And everything that Mr. Williams, Mr. Ginzberg and Mr. Lawrence talk about goes back to the issue that we are just consuming money and paying a large amount of our wage bill to the bureaucracy, who then create the unbalance of trade and so forth because

there is no production to go with that. And therefore, productivity targeting in my view then becomes the objective of your concerns.

Mr. LEWIS. Thank you. Thank you, Mr. Chairman.

Mr. MACKAY. My question would be—you are saying essentially that the management has stayed the same, and the addition of the new capabilities, the new informational flow capabilities on the old management style, has reduced and not enhanced. And you have suggested that NSF see in its role perhaps a review of this. And are you suggesting that we look at this as somehow basic science research?

Mr. STRASSMANN. Correct. As a matter of fact, Mr. MacKay, there is a glimmer of light in there because when you study superb organizations—and we have organizations who have slimmed down, who don't have overhead, who have been able to delegate responsibility down to the shop floor, and have better productivity in the steel industry than the Japanese, for instance. And if you study those examples of excellence—and I am talking about in search of excellence, you discover some very important new insights how policies should be directed so that we emulate the excellent and don't pass legislation that buttresses the old and inefficient and creates more of what we are against.

Mr. MACKAY. All right. I thank you. I need to excuse myself for a minute. Mr. Packard, if you would assume the Chair, and I think it is also your turn to ask a question.

Mr. PACKARD. Thank you. I apologize. I had to step out to another hearing for a few minutes, and maybe this question was asked.

But certainly one of the concerns that was brought up was the question of basic skills versus transferring of or relocation of the employment base, and that the basic and fundamental skills are more necessary—I think it was Mr. Strassmann might have mentioned this—are more important to successfully being able to move the employment base around than perhaps retraining and so forth. I would like someone to elaborate on that. What can we do then to improve the basic skills in our educational systems and perhaps other areas in order to qualify our work force to better manage the more mobile employment base that we now have to live with? Dr. Mowery?

Dr. MOWERY. I think that with respect to labor force entrants—you are talking about two groups here, entrants and the displaced experienced workers. For labor force entrants there are a number of reports and studies being conducted on how to improve the quality and the quantity of basic skills preparation for these individuals.

I think for the experienced worker there clearly is a considerable lack of attention to the basic skills training function within the existing Title III of the Job Training Partnership Act. There is virtually none provided largely because of the administrative regulations governing the operation of that program, not because of the statutes per se. It is partly because of the emphasis within the JTPA organization on rapid placement.

Mr. PACKARD. But isn't it very difficult to go back and some of the older skilled people that need retraining or relocation—isn't it very difficult to go back and deal with, for instance, basic commu-

nications skills, basic language skills, and problem skills that were mentioned in some of the testimony?

Dr. MOWERY. It is difficult and it seems oftentimes to be the case that trying to bring what may be middle aged workers into a classroom environment is one of the surest ways to discourage their participation and the effectiveness of the training, but there are some models of successful delivery of basic skills retraining for experienced displaced workers. There needs to be more study of what works and what doesn't because of the fact there has been so little evaluation of these programs, but there are models that could be emulated more broadly.

And the point is that right now under the existing administrative mechanisms for existing publicly funded displaced worker programs, at least federally funded displaced worker programs—that type of training is actively discouraged by the incentives that exist within those programs.

Mr. PACKARD. One other question, and then we'll go around again for those that would like to have follow-up questions.

I can't remember who it was—perhaps you, Dr. Lawrence—that mentioned the concept of the community impacts upon industry transfer out of communities. And certainly some of our steel cities, some of our oil cities in the southern states and other places, the timber industry and so forth—they have had major impacts upon the economic soundness of communities. Coming out of local government myself, that is of importance to me.

You mentioned some kind of an insurance program that might protect cities from the impacts of relocation of industries and economic dislocation. Were you thinking or would you expound upon it enough to whether it be subsidized by government or government insurance, whether it be private sector insured or how that could best be implemented?

Dr. LAWRENCE. Well, there may be a variety of ways of doing this, and I certainly don't have all the answers. Our idea was—indeed, we did a few simulation studies. We took a sample of counties. We just chose the county level, but it didn't have to be that, obviously. We took counties in Pennsylvania, in Texas and in Michigan. We arbitrarily selected a bunch of them. We figured they had had a lot of structural dislocation over the last decade. And then we asked, let's imagine we try to do this thing on a self-financing basis, and we simulated what it would take to operate a self-financing insurance program where the counties would all contribute a certain proportion of their tax base each year.

And it turned out it depends on how generous your program is going go to be, but the numbers came out at like one-twentieth of one percent of the tax revenues would go into this insurance program. And then if any county experienced a shortfall of greater than 5 percent in its tax revenues in a particular year, it would then be compensated for half of the shortfall that it experienced. But we just chose these terms.

And we found that you could operate this thing on a self-financing basis. Essentially what we are doing is we are pooling this risk which does not hit all communities at the same time.

Mr. PACKARD. But it would be a national scope.

Dr. LAWRENCE. But our idea would be that you could do it on a national scope.

You could apply the same principle at a state level. But in the sense the greater gains from diversification would clearly be enjoyed if you did it at a national level. We write about it in the study, which is called "Saving Free Trade," and I would be happy to send you a discussion of this particular program.

Mr. PACKARD. A very interesting concept.

One last question and that is in regard to I believe it was your comment, Mr. Strassmann, that we ought to consider a product impact or an economic impact statement when we deal with programs and projects. And I had thought of that some time ago. Do you have any details on how that could be implemented and how that—oh, I apologize. Mr. Williams. I apologize.

Mr. WILLIAMS. Thank you. I just wanted to apologize. I really have to excuse myself. I have——

Mr. PACKARD. You wanted to make a comment though on the last question.

Mr. WILLIAMS. No. I just wanted to interrupt the proceedings in order to excuse myself and thank you for the opportunity to be here.

Mr. PACKARD. Before you leave, is there anyone that would like to ask Mr. Williams a question?

Miss SCHNEIDER. I'm sorry, but I do. I have a very quick question for you, and it has to do with labor-management cooperation. I wonder if you could just quickly name for me some of those labor unions that you are working with in association to put forward the philosophy of, as opposed to previous confrontational experiences with management, a new effort now to work more cooperatively because I believe that labor and management has recognized that they are in this together. And I wonder if you could just single out for me some of those labor unions that have some of the best programs or are exemplary in this effort.

Mr. WILLIAMS. Yes, surely. There a number of unions that are very interested in worker involvement and employee involvement schemes. We call them labor-management participation team efforts in the steel industry, but not all managements are persuaded in the efficacy of this.

Miss SCHNEIDER. Understood, but who has the best model——

Mr. WILLIAMS. So, we have many confrontational situations as well as some less adversarial and more problem solving.

Our union is much involved in those. The UAW is much involved in those. The Amalgamated Clothing Workers have an exemplary program with Xerox. As a matter of fact, in terms of union involvement, the communication workers are much involved in those kinds of programs with AT&T and others. We have some interesting worker involvement projects in LTV Steel and in National Steel and in Wheeling-Pittsburgh Steel and in Acme Steel and some other efforts. So, they are not all the same, and they are not all successful, and they are not even. But a great deal of that is going on.

Miss SCHNEIDER. I'm aware that it is going on, but I just wanted successful models that you could share with me because I am doing my own little study in this area.

Mr. WILLIAMS. Yes, probably the best quick source to get a view of the overall situation is Jerry Rosso's outfit in New York, Work Institute of America. Have I got it right? I'm on the board. I should have that right. But Jerry and his people really have I think probably a better overview than anybody else.

Miss SCHNEIDER. Well, I have the overview. I just wanted specific unions that you deal with.

Mr. WILLIAMS. Well, I mean, they can point out particular details as I have.

Miss SCHNEIDER. Well, I was concerned that the UAW had said that they were going to some time ago go to war with Ford Motor Company if they could not reach some agreement. And I found it interesting that the head of Ford said, well, we're not going to go to war with our employees. We are going to work with them and go to war with the Japanese.

Mr. WILLIAMS. Let me say a quick word in defense of collective bargaining. Collective bargaining, and the whole idea which is fundamental in our society that you can—that adversaries can find truth by the vigorous presentation of two sides of a question. Because many of us are involved in worker involvement and want to solve problems and want to move forward in an effective way, doesn't mean that we are turning our backs on collective bargaining.

Let me put it in my simple way. There are two questions involved: what is the size of the pie, and the other is the division of the pie. In terms of the size of the pie, we share the same objectives. You obviously can't negotiate much of an agreement from an outfit that just got out of business. So, we are interested in the size of the economic pie.

When it comes to dividing that pie, I don't think there is any other instrument consistent with the philosophy and the point of view of a democratic society except collective bargaining. Any other division of the pie is by its nature authoritarian. It is either done by government as in totalitarian countries or it is done in a unilateral way by management in terms of their own criteria. The democratic way to do it is to sit down across a table and negotiate about how this pie is to be divided among the workers and the other elements.

So, I wouldn't want anybody to think that because some of us are much involved in worker involvement that we are somehow deserting collective bargaining. Far from it.

Miss SCHNEIDER. Great. Thank you very much.

Mr. WILLIAMS. Thank you very much for the opportunity. I am sorry to leave.

Mr. MACKAY. We had assured you of a five minute summary, so I would like if you have any other things that we haven't covered, I would like to offer you that. I'm sorry that we have run out of time on your schedule.

Mr. WILLIAMS. In addition, I did want to make in connection with what I've just said—I did want to make the point that I hope nobody would take my earlier comments that were a vigorous defense of managing trade to mean that we believe the world will continue as it has and we don't need to focus in on change. We think we need to do all those things. We need to manage trade, and

we also need to look after our interests vis-a-vis what is going on out there in the global economy with some concern about what happens to American industry and American workers and all the rest of it. We also have to update and improve.

I would say quickly the American steel industry throughout most of this period has been the most productive steel industry in the world, and yet, that has not saved us from all these things that are happening. One needs to look at all the elements.

I also wanted to say quickly that technological change does destroy jobs. We sort of seem in some ways not to be saying that. And the obvious evidence you move into a plant or an industry with a lot of technological change, you can reduce the number of people working. We are not fighting that in the American labor movement, but we are—agriculture is an interesting example. We have reduced this employment enormously in agriculture, but we didn't wipe out agriculture. Agriculture exists as a vital part of the American economy and provides an enormous number of service jobs servicing that agricultural industry.

One of our great worries is that in this talk about shifting to a service economy, we are talking about wiping out industry and our ability to manufacture things. And that would have in our view disastrous results. We are going to have a smaller work force manufacturing things, but it is vitally important that we continue to have a manufacturing capability because that is what sustains the service industry then to look after it.

So, in my view it isn't service or manufacturing. It is that we need agriculture. We need manufacturing. We need service. We need education. We need all the pieces to have a viable economy.

Mr. MACKAY. Thank you very much, Mr. Williams.

Mr. WILLIAMS. Thank you very much.

Mr. MACKAY. All right. What we are going to do now, our advisory panel members have been sitting very patiently. If you have any comments, I would like to offer you an opportunity to make any comments or ask any questions, and then our remaining panelists—we'll give you a chance to sum up.

This has been a very helpful meeting. I would say that probably we may have put too much on the agenda for one meeting. However, it has been I think very productive.

Dale, let me start with you and we will go from your left to right.

Mr. COMPTON. Let me make only two very quick comments, Mr. Chairman. I just want to call attention to one sentence in the executive summary of Mr. Mowery's paper, attached to that, which gets back I think to Miss Schneider's question she asked earlier. It reads the following:

> Improvement in the basic literacy, problem solving, numerical reasoning and written communication skills of work force entrants is essential.

We have this two-pronged problem, upgrading our entrants and retraining.

Mr. MACKAY. Thank you very much. I think Dr. Ginzberg made that point also. And I started to get back into it, but that would have broadened us even further. And I think it is quite clear. We have got a problem of the work force entrant, and we have got a

problem of retraining the mature worker. And they are very, very different problems. And both of them are highly significant to the future of this country.

Miss SCHNEIDER. Let me also add, Buddy, if I might, that I think that we have another problem with occupational segregation when we look at the demographics of what we might anticipate for the future that will make up the work force, as was pointed out, women and minorities. What concerns me is the development of a two tier labor force, you know, the highly skilled and the lesser skilled, white men and then women and minorities on the other level.

I regrettably, Mr. Chairman, have to also run. But I would like to put out a request that if anyone is doing any studies about occupational segregation or has any solutions, I am interested in them.

Mr. MACKAY. Very good.

Miss SCHNEIDER. The other question that I had that came out of the report from the National Academy had to do with the slow rate of absorption of technological change. And I am interested in knowing whether that is as a result of industry and companies not having access to the information knowing that there is a technology that can do X, Y and Z, which is true in the area of disposal of hazardous waste—we have technological capability to recycle or reuse 75 percent of our hazardous waste. Most of the people in the states have no idea that this technology exists. So, information transfer is critical. So, is this part of the problem, or is it the will of the people in terms of pressure on part of the work force saying we don't want to automate? We don't want robotization. We have to hold onto our jobs and new technology means fewer employment opportunities. That is something I don't know if you have addressed or not.

Dr. MOWERY. I guess there are two points about this rate of absorption. The first point is that if you compare technological change to other types or sources of employment change, we make the argument that technological change typically moves more slowly because of the informational requirements for the widespread adoption of the technology.

Now, in terms of trying to develop or trying to diagnose why certain technologies have not been adopted more rapidly within the U.S. and perhaps more slowly in the U.S. by comparison with other nations, I think there are a couple of problems. One, which is alluded to in Dr. Lawrence's paper, is that the adoption of technology is an investment-driven process. And if capital formation rates are low, rates of adoption, rates of diffusion of new technology inevitably will be slow.

Certainly the panel discussed this issue of work force resistance, and the sense of panel members and the consensus of the panel was that this is not really a serious issue. It is not a serious issue in the sense that it can be managed effectively by worker-manager cooperation. It is clear that employment security is one of the greatest concerns of a work force in a factory or an office that is undergoing automation or the adoption of new technologies. But where assurances or policies can be adopted to deal with this, as they have been in many industries over the past 50 years, work force resistance is not a serious problem.

There is a serious informational problem of varying dimensions. I think there is a capital formation problem that underpins part of it. There also may be a role for some greater research funding on the part of the Federal Government in activities directed to both increasing the distribution of information and doing some of this debugging or so-called gray area research.

One of the points that the panel report makes is that in most areas Federal research policy has focused on the generation of scientific knowledge and a generation of new technologies. We as a nation are in a world in which this information travels more rapidly than ever before across national boundaries. And, therefore, the payoff increasingly comes from the embodiment in new products, the adoption in new process technologies, and there may be a role for exploring funding of some of these activities a little further downstream. It certainly has operated fairly effectively in agriculture. It has operated fairly effectively in aeronautics research. It has operated fairly effectively in areas of pharmaceuticals as well.

If I could make one more point with respect to your and Dale Compton's incentives comment or incentives with respect to advance notice, the panel report does propose two alternative routes to Federal action to ensure broader coverage of the work force by advance notice of layoffs and plant shutdowns. One is a mandate and the other is a tax-based incentive scheme.

Now, the issue with the second incentive scheme is that has the advantage of internalizing the costs of employers who don't provide advance notice. That is to say, they will pay higher taxes. They will bear a more significant share of the higher costs of unemployment that they create. However, it has the disadvantage of not benefiting the workers directly in the sense that unless some decision is made about the disposition of the revenues. If the proceeds of such a surcharge on unemployment insurance for managers who do not provide advance notice do not go to the laid-off workers, you are not directly benefiting the workers who are laid off without advance notice. There is also an issue about how large the tax would have to be in order to affect employer behavior. But it is an option that we do propose, partly as a result of earlier conversations with Dr. Compton.

Miss SCHNEIDER. Thank you.

Mr. MACKAY. All right, very good.

Let's go ahead.

Mr. WILLENBROCK. Thank you, Mr. Chairman.

I have been fascinated by the great emphasis on basic skills and the retraining and displacement problems. I would also point out that as you look a bit farther into other parts of the work force and look at the engineers and scientists, they are also crucially dependent on those basic skills. It seems the emphasis could well be placed there because the demographic changes which are anticipated, the very important role that the minorities and women will play in this area, are all also going to be crucially dependent on the basic skills we have available. So, it seems to me that is an important factor in practically all parts of our work force from the most skilled to the least skilled.

Mr. MACKAY. Thank you very much.

Dr. Johnson?

Mr. JOHNSON. I have just a brief comment. First of all, I found it very interesting to hear the variety of opinion. And I believe I share a concern with Miss Schneider about the occupational segregation that I see going on and the possibility of two tiers being formed in our employment.

Perhaps I look at it a little differently than the people who have commented earlier. My background is in high technology. I manage a substantial high technology work force. And I have been working recently very closely with a large number of senior managers from high technology private sector companies who are located geographically in the same area as the National Bureau of Standards.

One of the reasons we have been working together is that we feel a great deal of pressure from our employees to provide them with opportunities for continuing education. And in fact, from our point of view, high technology employees need to have continuing education available to them as sort of a way of life. It is a lifelong endeavor for people who are working in high technology fields.

And I am wondering if perhaps we are dealing with something we might call a cultural issue here where people who are trained in high technology areas and work in a high technology work force feel a need to continue their education in order to keep pace with the changing technical environment that they are immersed in on a daily basis and, therefore, are in a much better position and much more mobile when it comes to readjustments in their working environment than those who terminate their education at a very early stage and go into a blue collar kind of an environment which does not have the same emphasis on high technology.

Since we are really trying to focus here on what are the implications of high technology on the work force, I would really like to hear a little more comment perhaps in summary statements from the three of you who are remaining here about that view and whether you feel there is a difference in attitudes on the part of the workers towards education that needs to be worked on at some stage.

Mr. MACKAY. We will ask each of you to be thinking about that and perhaps respond.

I guess that is sort of the implication of what you had said, Mr. Compton, and what Dr. Ginzberg said about the fact that it is really two problems. We may be developing a group or a sizeable proportion of our work force who are just not going to be part of a technologically advanced society if we are not very careful.

Mr. JOHNSON. In fact, Mr. MacKay, if I just may emphasize what we see as—and I'm speaking now as a representative of a group of high technology employers—is a really a widening gap. We see our own employees and the employees of other high technology organizations having an ever-increasing appetite for more education and more exposure to a varied background.

And at the same time, we find high school graduates who come into our work force who do not even have basic keyboarding skills because typing is no longer required in high school. When I went to high school 25 years ago, it was required. But it is no longer required now even in public school systems that are serving high technology employment areas.

So, I think what we are seeing is a very, very much widening of the gap between what I would call technologically literate individuals who are working in a high technology environment and those who terminate their education early and take their employment in a low technology or no technology kind of environment.

Mr. MACKAY. Thank you very much.

All right. Let me ask Dr. Hill.

Dr. HILL. No questions.

Mr. MACKAY. All right, then we are at a point where we would like to hear any summary remarks that the three of you would care to make. Dr. Lawrence?

Dr. LAWRENCE. Well, I thought I would just reflect on three aspects of our society. We have a lot of trouble forecasting the future. But there are three things I think we know about the next 10 years that I think should guide our thoughts in this area of technology policy.

The first is demographics. We are going to be an older society. We have lived through now a decade of the baby boom era entering the labor force and of a vast number of women who have made decisions to enter the labor force simultaneously. In a sense we have been living in a world of cheap, new entry labor. That is over.

As we look out over the next decade, what we know is we confront the baby bust generation and the proportion of women entering the labor force is going to level out. And that is going to mean a change in the ratio of those new entrants to the existing labor force participants. And that, in turn, implies—indeed, I think it is 100 percent correct—that we stress these two modes of training, training for the new entrants and training for the existing workers.

But what we know about our society is that increasingly it is going to be the existing workers who have to be retrained. When you get a lot of new entrants into your labor force, they easily obtain skills. But when you run short of them, as we are going to over the next decade, it has got to be the existing labor force who enjoys more of the emphasis of the policy. Our policies have to change as a result of that.

The second thing we know about the future is that the United States has become a world debtor nation. True, the world has been willing to lend to us while we have been engaged in the spending binge. But what we know about the future is at a minimum you have to service your debt. We see it with the developing countries today. They have no choice but to learn to export. The same is true of the U.S. looking over the next decade. The issue is whether we are going to do it at a reasonable level of dollar or at a dollar that totally undermines our living standards. Be that as it may, we are going to have to adjust.

And that, as many have pointed out, hinges I think ultimately on our manufacturing sector because that's the dominant source of traded goods in the economy. We are going to have to learn to reverse and to, indeed, improve upon our picture in trade. And I think ultimately that does rest on technology.

I also think it requires us to take a global perspective that we are too parochial in our institutional framework. And one aspect that we haven't discussed here today, but I think ought to be

brought up, is what we can do to give our work force a global perspective and, indeed, our managers a global perspective. What do we do to encourage people to travel? What do we do to encourage people to obtain language skills?

I think there is an abysmal ignorance about the state of technology in the rest of the world, the degree to which in many areas foreigners have overtaken us. And we have now the advantage of being in a sense number two in certain areas. We don't have to innovate totally. We can copy. We have learned that in our auto industry as the Japanese have moved in bringing with them the superior management techniques. But I think that exploiting this capacity to learn from others rather than to innovate and do it all alone is something that is going to be more open to us as, indeed, we become closer to a situation of first among equals, if you will, rather than this dominant technological giant.

The third point I would like to make is indeed one which I think Mr. Strassmann has emphasized--very important—and that is we are a services economy. There has in my judgment been no diminution in our capacity to produce goods. But the fact of the matter is that goods account for about 40 percent of our GNP. So, 60 percent of our gross national product is in services.

And if you look since 1973, what is striking is that productivity growth in goods areas has not done all that badly. In fact, it now looks in the last few years that we have returned more or less to the historic rate of improvement in manufacturing that we had before 1973. But if we look in the services area, we find there has been literally zero productivity growth over the period.

And that ironically, rather than our international competitiveness, is the biggest drain on our living standards today. Unless we can find a way to improve our services productivity, as I say, 60 percent of what we are producing, that is going to be the dominant source of our living standard improvements.

So, I do applaud the quite novel notion that we should not simply be looking at the goods areas. And indeed, what is striking is how little R&D expenditures takes place in services production. Almost all our R&D is taking place in manufacturing. Why aren't we spending on R&D and services. We know abysmally little about the slowdown in services productivity.

And again I applaud the notion that the National Science Foundation ought to be appointing a commission to investigate and to mobilize the kind of knowledge that we may well put in the battle against cancer. It is just as important if you will, from the standpoint of our future that we learn what works and what doesn't in this huge proportion of our economy where our productivity growth has been so poor.

So, those are my three ideas. We are an older economy. We are a debtor nation, and we are a services economy. And those three elements are going to be with us over the next decade and deserve a lot of attention.

Thank you.

Mr. MACKAY. Thank you very much.

All right, Mr. Strassmann?

Mr. STRASSMANN. Before I summarize, I would like to answer a question Mr. Packard asked regarding the methods I would suggest

using in doing what is called a productivity assessment impact as part of any legislative initiative.

The whole idea of life cycle costing of any kind of a program is well-established both in the administrative part of the Defense Department, also in the congressional reviews. When you are passing a bill, whether it is a plant closing bill, or whether it is a bill concerned with changing the depreciation method for inventory accounting, the same kind of techniques which I used in life cycle costing in the Defense Department are applicable there. And therefore, I think it would take a major initiative on the part of congressional committees to look at the life cycle impact of Federal action on service sector productivity.

Now, if I may sum up, Mr. Chairman, I think I got excellent support for my argument, what is the biggest drain in our future. And clearly the biggest drain that we are currently experiencing is the sector which I would not call just service economy because this includes also private services—I would call it the information sector of the economy, which includes management of our enterprises. And I would say that is the biggest drain we have. This is a totally unexpected drain when you look at our overhead costs. They have been going up steadily. Manufacturing labor today averages between 200 to 400 percent overhead burden on direct costs, which is a disgrace.

And I think that rather than concentrate what Congress has always concentrated on, first, on generation of technology—in supporting generation of technology—and then passing legislation to try to salvage some of the damage the technology may have done, let's go square in the middle and get it right—namely, manage the technology right.

And that means that I feel that the National Science Foundation and other sources of Federal and congressional initiatives ought to concentrate on the exploration and investment of research in the productivity of the information handling sector as the way how we can increase the pie after which we can then decide all of the other ways how to spend the pie on including education, displaced workers, and so forth. But until the pie grows—and it is not growing sufficiently—we are not going to have a viable environment. And that means refocusing of attention.

Thank you.

Mr. MACKAY. Thank you.

Dr. Mowery.

Dr. MOWERY. Let me begin by responding briefly to the comment about the cultural gap between high and low technology industry.

I think that one of the things in our study we tried to avoid, and I think that something that sometimes is not helpful in thinking about some of these economy-wide issues of productivity growth and the impact of technology, is to build a wall between high and low technology industry. It seems to me, it seemed to the panel for which I was working, that what we are going to be seeing, if we are going to revive productivity growth in the—or continue productivity growth, I should say, in the manufacturing sector and strengthen competitiveness is the absorption by low-tech or no-tech industries of the products and the process of high technology industry. And I think that imposes on the management of these firms and

the workers a joint responsibility for a more or less continuous process of skill upgrade and retraining.

It is clear that one of the key expenses that is often overlooked and ignored in the adoption of things, like flexible manufacturing systems, in the manufacturing sector is the need to virtually continuously invest in retraining and upgrading the skills of the manufacturing blue collar work force. There is clearly a need for better basic skills preparation on the part of the entrants, but once in the work place, management and workers generally are going to have to accept the need for a more or less continuous upgrade, training function. And this is a matter of a diffusion of a cultural norm, if you will, or a practice.

My other two points go to the issues of what we don't know. And in the context of this session of the Congress, this issue is particularly important. And I repeat myself again to underline the need, in the context of new initiatives in worker adjustment assistance, to include a substantial portion of funding or of program variation for evaluation and analysis of how these programs are working. We have spent a considerable sum of money in the last five years on JTPA, and there have been approximately three substantial, rigorous evaluations of individual programs within that large Federal program.

We know a very small amount about what features of program design aid workers and what features of program design are not helpful. We have evidence suggesting that these adjustment assistance programs do work, but we don't really understand why as well as we should if we are talking about spending $980 million.

My other point about what we don't know goes to the very cogent arguments raised about the salience of the service sector and its poorly measured productivity growth. I think that one of the critical needs in the area of data collection that is widely overlooked—and this is one of the key findings of the panel—is that in many areas of this larger issue of technology's impact on employment, existing public data bases are poorly maintained. Funding for many of them has been reduced, and we are really flying blind. This applies both to manufacturing, but particularly to the service sector.

And I think we need to not only fund additional research in the management of productivity growth and technological change in the service sector, but we need to strengthen the collection and analysis of data, just the basic facts of employment growth of technological trends of international trade in services which currently are scarcely counted at all. So, not only do we need to fund research, we need to fund the generation of the raw materials for the research, which in this case are data.

Thank you.

Mr. MACKAY. This has been an extremely productive hearing. I want to thank all of you for your participation. I hope that you found it to be productive. And I hope that as we go forward, perhaps we can stay in touch and get your reaction to the directions that this task force is taking. Thank you very much.

[Whereupon, at 12:30 p.m., the task force was adjourned.]

APPENDIX

CONSERVATION OF HUMAN RESOURCES
COLUMBIA UNIVERSITY
NEW YORK, N.Y. 10027

ELI GINZBERG, DIRECTOR

RECEIVED
JUL 23 1987
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

July 13, 1987

Honorable Buddy MacKay, Chairman
Technology Policy Task Force
U.S. House of Representatives
Committee on Science, Space, and Technology
Suite 2321 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. MacKay:

I appreciated very much your invitation to meet wih you and the members of your Task Force and your seeing to it that I couldmake my plane.

I thought it might be of some value to your Task Frce if I added a few observations based on the Panel's presenters and te members' questions.

--Technology is not the "bad boy" in our currntly declining industries like steel. There is no way for the U.S. t get itself repositioned in the new world economy without heavy relince on new and better technology.

--In short, Congress should keep its eye on strengthening our technological base, not restricting it. My own view is that we have a lopsided federal R&D with too much money going into defense.

--I agree with Lawrence's presentation that the U.S. economy is in big trouble because we are living beyond our means and I don't see any early escape. The tax reduction program in '81 was a disaster in my view and Congress needs to bring the federal budget into balance much more quickly.

--The middle-term outlook, 2-3 years, is in my opinion bleak because I don't see much, if any likelihood, that we can escape a recession which could lead to astronomical deficits.

--The Technology and Employment Report by the OAS which I had an opportunity to read in its entirety, is a reasonable document. It is a good job at de-mystification.

--On the policy front, I see some gains in 90 day advance notice for plant closures; and an amendment to Social Security enabling workers with 20 years employment with a firm that shuts down to receive

reduced benefits between 58 and 62. I failed to mention the next point: the federal-state UI system should enable all workers on UI to continue to be eligible for benefits while pursuing training courses.

--The federal government must keep addressing the serious deficiency that I called attention to--that is encouraging state and local governments and the private sector to provide second and third chance opportunities to young people who drop out of high school lacking basic competences--arithmetic, reading, communication--without which they can't get or hold a job in the service economy that currently provides 3 out of every 4 jobs. Good technology without a competent labor force is not the answer to our economic future. And American society is at risk if a significant minority of all our citizens cannot become self-supporting.

--The U.S. is not being deindustrialized but the high earning blue collar work force is diminishing and will shrink further. However, there are many good middle level technician jobs in the service sector.

--The argument that services are not productive is bad theory and worse statistics. We don't know how to measure productivity in services.

--I am sympathetic to many of Mr. Williams' comments about the devestation that has occurred in many steel communities and to many steel workers and their families. But I think that a hard look at government interventions in steel will show that it has been costly and of not much help to anybody. My preference is to help the workers, not the firms. After all, we live in a capitalistic world and that means that the consequences of poor management are losses and bankruptcies.

--I thought that Lawrence made a strong presentation but he promised too much. There is more going on in the international trade and financial markets than an overvalued dollar. I don't think we are anywhere near a new balance point.

--Finally I believe we must get the federal budget back in balance so that the federal government can do some of the things that need doing such as more investment for R&D, for improving the human resources of the nation, helping the displaced workers etc. We need to raise taxes, reduce many of our high subsidy programs, and slow down our defense outlays. On the basis of my long exposure to the Pentagon I'm sure that giving more money to the Armed Forces makes them, after a point, less not more effective.

In high esteem,

Sincerely,

Eli Ginzberg

Answers to Additional Questions

1. I believe that the federal government should move with considerable caution to introduce specially targeted programs to ease the problems of dislocated workers. The reasons for this recommended caution is that it is often hard or impossible to determine whether plant shutdowns and ensuing unemployment reflect trade imbalances and other causes (poor management) or some combinations of both. Further, I believe that our efforts to date with special adjustments such as TAA were not satisfactory and were costly. I see merit in 90 day notice for plant shutdowns for all units of 100 or more employees. I also would approve an amendment to Social Security allowing workers between the ages of 58 and 62 and with 20 or more years employment in shut-down plant to receive reduced benefits at 58. One should avoid putting the costs of large underfunded pension plans on the federal system or the U.S. Treasury.

It is desirable to have reasonable amounts of retraining money in the JPTA program available for workers who need and want and can profit from retraining. But the sad fact is that many workers with minimal educational competences cannot be effectively retrained. They can best profit from a stronger federal-state employment system with improved counseling and placement assistance. I have long favored a federally financed jobs program at minimum wages--with remedial educational opportunities--for those who need a job. Admittedly the latter would require new funding and I see no alternative but to raise taxes to cover the cost.

2. I am strongly of the belief that the steady shift to more service jobs carries with it rising requirements for literacy. Since inner-city schools

face very high drop-out rates, many minority youth are coming into the labor force blocked from competing for mainline jobs. There is need to do at least three things: offer part-time and summer jobs to high school youngsters to encourage them to see the importance of present schooling to future work; try to offer more support to the school system via volunteer tutoring, short-term service contracts for college grads etc., and more and better second-chance remedial programs at junior colleges and under other auspices.

3. This question overlaps with 2. I don't think that the emphasis should be placed on high-tech jobs but rather on raising the low competence levels of young people who are school drop-outs. My strong impression is that we have not focused sufficiently on the tough job of doing the remedial work. Since the young people who drop out of school have a negative image of the educational process, it is important to try to reduce the drop-out rate by offering them part-time jobs in which they may be interested. Similarly, after they drop out, one cannot get them back into school simply for remedial work. Such an effort must be linked with jobs and training.

4. I am reasonably well acquainted with the experience of the leading Western European nations. In all of these countries, the minorities at the bottom face problems of poor educational preparation and difficulties of getting a regular job. Most remedial efforts in these countries have had at best limited success. I don't know of any specific approach that can be readily transferred to this country.

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July 17, 1987

Mr. Buddy Mackay, Chairman of Technology Policy Task Force
Committee on Science, Space, and Technology
U.S. House of Representatives
Suite 2321 Rayburn Building
Washington, DC 20515

Dear Mr. Mackay:

Each of the follow-up questions in your letter of July 14 deserves a testimony. However, I assume that you wish that I concentrate on major issues, in action-oriented terms:

Question #4: *What are illustrations of lessons we can learn from the experience of other nations as we consider future policies?*

> We are evolving from an era where labor was considered a wage-earning input. We are moving to a society where the knowledge of our workforce is our most valuable resource. We need wage policies that reflect a departure from the practices of the industrial age.
>
> The Japanese as well as a small, but significant, number of U.S. companies practice some form of gain-sharing. This is an approach which allows for only a portion of income to come from wages. A large fraction, sometimes exceeding 50 to 100% of base pay, is earned on the basis of the overall performance of the enterprise and on an individual's contribution to its success.
>
> The theoretical meaning of any gain-sharing is far-reaching. It implies a departure from the traditional theory of wages and how wages are set. As an active participant in the success or failure of a business the employee cannot be seen any more as someone who just rents his time at a contract wage rate. The employee becomes partially an owner because he contributes not only labor but also capital in the form of his knowledge and personal involvement. Thus, as any investor, he shares not only in risks but also in the gains.
>
> The policy consequences of a widespread adoption of gain-sharing are far-reaching. For instance, it would suggest that all gain-sharing should be treated as capital gains and not as income. This would change tax laws. It would also alter the way how individuals perceive their ability to influence the workplace and working conditions.

Firms that use some sort of gain-sharing show better productivity, enhanced job-formation, improved industrial relations, greater competitiveness and superior social concerns, thus relieving much of the persistent pressure for ever increasing amounts of legislative and regulatory actions.

The lessons to be learned from businesses that treat their employees as part-owners should influence **Congress to adopt a national policy supporting gain-sharing.**

Question #3: *What specific public and private sector policies would you recommend?*

If an employee's knowledge is his capital, and the basis for a major share of his earnings, then all education and training should be given the same preferential treatment as we have given traditionally to capital. In the industrial age societal productivity was largely determined by the easy availability of capital. The encouragement and protection of capital formation, whether in the form of assets or technology, has always been one of the prime objective of government policies.

In the information age, the knowledge capacity of the workforce is the basis of societal productivity gains. Capital is plentiful and becomes an easily available commodity, on a global scale. Hence, legislative policy should shift from concerns about capital to preferential treatment of every conceivable means for enhancing the knowledge capacity of the U.S. workforce.

Specifically, **Congress should adopt the policy that all educational and training expenses should become fully tax-deductible and, in special cases, eligible for a depletion allowance. This shift should be financed by a gradual removal of the preferential tax treatment given to the role of physical assets.** In this regard, the recent elimination of the investment tax credit was a move in the right direction. However, the gains in tax revenues should have been re-invested into the creation of new knowledge capital.

Question #5: *What factors contributed to the gains in the productivity of production workers while the information workers' productivity declined?*

The severe cutback in production employment during the past 15 years had, as a favorable by-product, the elimination of inefficient U.S. organizations that could not compete in the global marketplace. The "creative destruction" of this process is largely the result of the free world-wide access to national markets for manufacturing goods. Under such circumstances local inefficiencies cannot survive.

This experience should be seen as an important lesson for the Congress. To offset employment losses in the efficiency-gaining production sector, we generated new but inefficient employment opportunities in the information sector. This was possible because there is not yet a viable global market for information services. If and when it comes, the present accumulation of unproductive practices in the U.S. will create a massive upheaval, exceeding in severity what we have so far experienced in the decline of industrial America.

The existing practices and policies of the U.S. government contribute to the lack of productivity in the information sector. The government continues to impose an increasingly costly burden on the information sector, through bureaucratization of its management practices. We should not have to go through the painful experiences of the production sector to be forced into restoring productivity in the information sector in some not-so-distant future! Therefore, I recommend that Congress re-directs some of its attention from a preoccupation with the problems of the production sector to the emerging problems of the new information-based economy.

I trust that the above answers will he helpful in your further deliberations.

Sincerely,

Paul A. Strassmann